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Assessment of Unregulated Emissions from Gasoline Oxygenated Blends

Southwest Research Inst., San Antonio, TX

Prepared for:

Environmental Protection Agency, Ann Arbor, MI

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16. ABSTRACT

Four gasoline or gasoline-oxygenate blend fuels were used in the evaluation of regulated and unregulated emissions for five test vehicles. The fuels listed below were all prepared from a common base gasoline and were blended to have equal octane ratings.

- Baseline, aromatic-enriched
- 10% Ethanol blend
- 16.4% Methyl tertiary-butyl ether (MTBE) blend
- 19.1% Ethyl tertiary-butyl ether (ETBE) blend

The five test vehicles represented different types of emissions control technology: pre-catalyst, oxidation catalyst, three-way catalyst with closed-loop carburetor operation and an air pump, three-way catalyst with throttle body fuel injection, and three-way catalyst with port fuel injection. Each vehicle was operated with each fuel over the Federal Test Procedure (including evaporative emissions) for a total of 15 tests per vehicle. Several unregulated exhaust emissions were measured including ethylene, 1,3-butadiene, isobutylene, benzene, toluene, o-, m-, and p-xylenes, formaldehyde, acetaldehyde, ethanol, MTBE, and nitrous oxide. In addition, evaporative emissions were analyzed for MTBE, benzene, and ethanol. The emission data from tests using the ethanol, MTBE, and ETBE blends were compared to emissions produced from tests using the aromatic-enriched baseline fuel to determine if there were any statistically significant differences associated with the use of the blends.

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FOREWORD

This project was conducted for the U.S. Environmental Protection Agency by the Department of Emissions Research, Southwest Research Institute. The program, authorized under Contract 68-C9-0004, was initiated March 3, 1989, and was completed in September 1990. It was identified within Southwest Research Institute as Project 08-2809. The EPA Project Officer for the program was Mr. Craig A. Harvey of the Emission Control Technology Division, Ann Arbor, Michigan. SwRI Project Manager was Dr. Lawrence R. Smith and the Project Leader was Ms. Mary Ann Warner-Selph. Mr. Jimmie Chessher, Laboratory Supervisor, was responsible for emission testing. Mr. Norman R. Sefer, Principal Engineer with the Fuels and Lubricants Research Division at SwRI, handled fuels acquisition and blending. The ETBE was provided by the following organizations: BioCom USA Limited, Farmland Industries, Gulf Oil, Nebraska Gasohol Committee, and American Eagle Fuels. In addition, Texaco Chemical Company donated the MTBE used in this program.

ABSTRACT

Four gasoline or gasoline-oxygenate blend fuels were used in the evaluation of regulated and unregulated emissions for five test vehicles. The fuels listed below were all prepared from a common base gasoline and were blended to have equal octane ratings.

- Baseline, aromatic-enriched
- 10% Ethanol blend
- 16.4% Methyl tertiary-butyl ether (MTBE) blend
- 19.1% Ethyl tertiary-butyl ether (ETBE) blend

The five test vehicles represented different types of emissions control technology: pre-catalyst, oxidation catalyst, three-way catalyst with closed-loop carburetor operation and an air pump, three-way catalyst with throttle body fuel injection, and three-way catalyst with port fuel injection. Each vehicle was operated with each fuel over the Federal Test Procedure (including evaporative emissions) for a total of 15 tests per vehicle. Several unregulated exhaust emissions were measured including ethylene, 1,3-butadiene, isobutylene, benzene, toluene, o-, m-, and p-xylenes, formaldehyde, acetaldehyde, ethanol, MTBE, and nitrous oxide. In addition, evaporative emissions were analyzed for MTBE, benzene, and ethanol. The emission data from tests using the ethanol, MTBE, and ETBE blends were compared to emissions produced from tests using the aromatic-enriched baseline fuel to determine if there were any statistically significant differences associated with the use of the blends.

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SUMMARY

The effects of three oxygenated-blend gasoline fuels and an aromatic-enriched gasoline fuel on vehicle emissions were investigated in this program. The oxygenate-blend fuels included a 10 percent ethanol blend, a 16.4 percent MTBE blend, and a 19.1 percent ETBE blend, each prepared from a base fuel. The aromatic-enriched fuel (35.5 percent aromatics) was also prepared from the base fuel by addition of a mixture of toluene and xylenes. The octane numbers (R+M/2) of the four fuels ranged between 89.5 and 89.6. Five vehicles were tested with these fuels, with each vehicle representing a different stage of emission control technology. The first vehicle was a pre-catalyst 1974 Chevrolet Impala. The second vehicle, a 1977 Mercury Marquis, was equipped with an oxidation catalyst. The third test vehicle, a 1983 Buick Regal, was carbureted (closed-loop operation) and was equipped with a three-way catalyst and an air pump. The fourth and fifth test cars were 1990 model year vehicles with three-way catalysts and no air injection. The fourth vehicle, a 1990 Chevrolet Lumina, was equipped with throttle body fuel injection while the fifth test car, a 1990 Ford Probe, was equipped with port fuel injection.

Each vehicle was operated over the Federal Test Procedure (FTP) with the four test fuels for a total of 15 tests per vehicle. Regulated gaseous emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen), fuel economy, and several unregulated emissions, including ethylene, 1,3-butadiene, isobutylene, benzene, toluene, o-, m-, and p-xylenes, formaldehyde, acetaldehyde, ethanol, MTBE, and nitrous oxide were measured on these tests. In addition, MTBE, benzene, ethanol, and total hydrocarbon emissions were measured in evaporative emissions tests. A hydrocarbon speciation method was adapted for the measurement of MTBE in exhaust and evaporative emissions. Comparisons of unregulated emissions from tests conducted with the three oxygenated fuel blends to tests performed with the baseline, aromatic-enriched fuel were made to determine if any statistically significant emissions differences occurred between fuels.

Unregulated emissions data were evaluated using the two-sample Wilcoxon Rank Sum Test. This method is applicable for the small sample sizes generated in this program. Statistically significant differences in unregulated emissions from the oxygenated blends compared to the baseline fuel are noted in the Summary Table. Regulated emissions (HC, CO, NO_x, and evaporative HC) and fuel economies were simply compared on the basis of overlap of the emissions or fuel economy values (± 1 standard deviation) between the baseline fuel and the oxygenated blends. Several observations were made from the analysis of the regulated and unregulated emissions test data. These observations are given below:

- In general, fuel economy and CO emissions were found to be lower during operation with the oxygenated blends relative to the baseline aromatic-enriched fuel.

- Isobutylene, a fragmentation product of both MTBE and ETBE, was produced during operation of all five vehicles with the MTBE and ETBE blends at rates higher than for the baseline fuel.

- The emissions of the aromatic compounds measured in this program, benzene, toluene, and m-,p-, and o-xylenes, were generally lower from the oxygenated blends. (The blend fuels had lower concentrations of aromatics, from 18 to 23 volume percent, compared to 35 percent in the baseline fuel.)

- There was a tendency toward increased formaldehyde emissions with the MTBE blend and increased acetaldehyde emissions with the ethanol and the ETBE blends.

SUMMARY TABLE. STATISTICALLY SIGNIFICANT DIFFERENCES IN UNREGULATED EMISSIONS (FOR THREE OR MORE TEST VEHICLES) FROM OXYGENATED FUEL BLENDS RELATIVE TO AN AROMATIC-ENRICHED BASELINE GASOLINE FUEL

		10% Ethanol (EM-906-F)	16.4% MTBE (EM-907-F)	19.1% ETBE (EM-908-F)
		Higher/ Lower[a]	Higher/ Lower[a]	Higher/ Lower[a]
Isobutylene	1974 Impala		H	H
	1977 Marquis		H	H
	1983 Regal		H	H
	1990 Lumina		H	H
	1990 Probe		H	H
Benzene	1974 Impala	L	L	L
	1977 Marquis		L	
	1983 Regal		L	L
	1990 Lumina	L	L	L
	1990 Probe	L	L	L
Toluene, m-, p-, o-Xylenes	1974 Impala	L	L	L
	1977 Marquis	L	L	L
	1983 Regal	L	L	L
	1990 Lumina	L	L	L
	1990 Probe	L	L	L
Formaldehyde	1974 Impala		H	
	1977 Marquis		H	
	1983 Regal			
	1990 Lumina		H	
	1990 Probe			
Acetaldehyde	1974 Impala	H		H
	1977 Marquis	H		H
	1983 Regal	H		H
	1990 Lumina			
	1990 Probe	H		H
Total Aldehydes and Ketones	1974 Impala			H
	1977 Marquis	H		H
	1983 Regal	H		
	1990 Lumina	H		H
	1990 Probe			

SUMMARY TABLE (CONT'D). STATISTICALLY SIGNIFICANT DIFFERENCES IN UNREGULATED EMISSIONS (FOR THREE OR MORE TEST VEHICLES) FROM OXYGENATED FUEL BLENDS RELATIVE TO AN AROMATIC-ENRICHED BASELINE GASOLINE FUEL

		10% Ethanol (EM-906-F)	16.4% MTBE (EM-907-F)	19.1% ETBE (EM-908-F)
		Higher/ Lower[a]	Higher/ Lower[a]	Higher/ Lower[a]
Ethanol	1974 Impala	H		
	1977 Marquis	H		
	1983 Regal			
	1990 Lumina			
	1990 Probe	H		
MTBE	1974 Impala		H	
	1977 Marquis		H	
	1983 Regal		H	
	1990 Lumina		H	
	1990 Probe		H	
Evaporative Ethanol	1974 Impala	H		
	1977 Marquis	H		
	1983 Regal	H		
	1990 Lumina	H		
	1990 Probe			
Evaporative MTBE	1974 Impala		H	
	1977 Marquis		H	
	1983 Regal		H	
	1990 Lumina		H	
	1990 Probe		H	
Ethylene, 1,3-Butadiene, N_2O, Evaporative Benzene	1974 Impala			
	1977 Marquis			
	1983 Regal			
	1990 Lumina			
	1990 Probe			

[a] H - Emission rate of compound is higher than for baseline fuel.
L - Emission rate of compound is lower than for baseline fuel.
Blank space indicates emissions not statistically higher or lower than for baseline fuel.

Formaldehyde is formed as an oxidation product of MTBE, and acetaldehyde is an oxidation product of ethanol and ETBE.

- Exhaust and evaporative emissions of ethanol and MTBE were generally greater from their respective blends than from the baseline fuel. It is likely that ETBE emissions were greater from the ETBE blends, but no ETBE measurement procedure was available.
- In general, ethylene, 1,3-butadiene, nitrous oxide (N_2O), and evaporative benzene emissions were not statistically different for the vehicles operating on the oxygenated blends as compared to the aromatic-enriched baseline fuel.

I. INTRODUCTION

A number of states require and other states are considering the use of oxygenated gasoline blends (e.g., 10% ethanol or up to 15% MTBE) as a strategy for winter carbon monoxide reduction. Oxygenated compounds such as ethanol, MTBE, and ETBE can also be used to increase the octane content of gasoline. This feature is attractive in view of the current interest in reducing vehicular benzene emissions. Benzene emissions can be reduced by lowering the aromatic content of fuels, but this change usually lowers the octane number of fuels. Oxygenates can, therefore, serve a dual role in the reduction of carbon monoxide emissions and the increase in fuel octane.

Several studies have investigated total aldehyde and/or formaldehyde emissions from blend-fueled vehicles. However, very few have measured benzene emissions, and none have measured the effects of blends on evaporative benzene emissions. In addition, no single study has measured benzene and individual aldehyde emissions from ethanol-, MTBE-, and ETBE-blend-fueled vehicles, nor related these emissions to those from comparable-octane unleaded gasoline. This program addressed the issues by including the measurement of benzene, aldehydes, and other substances from several vehicles fueled with oxygenated blends and an octane-matched aromatic-enriched baseline fuel. Given the small number and wide diversity of test vehicles, this study was not intended to characterize fleet average effects, but rather to check for substantial unexpected changes in unregulated emissions. No such changes were found.

A. Objective

The objective of this study has been to determine regulated and several unregulated evaporative and exhaust emissions from vehicles operated with an aromatic-enriched baseline gasoline fuel, a 10 percent ethanol blend, a 16.4% MTBE blend, and a 19.1% ETBE blend. The fuels were prepared to yield comparable octane numbers and RVPs (the ethanol blend was allowed a 1 psi higher RVP).

B. Scope

Five vehicles representing different emission control technologies were employed for emissions testing. Each vehicle was tested according to the light-duty Federal Test Procedure (FTP).(1)* Multiple evaluations with each fuel were performed for a total of fifteen FTP tests per vehicle, or 75 tests total (15 tests x 5 vehicles). Regulated and several unregulated emissions were determined during evaporative and exhaust emissions tests. Benzene, ethanol, and MTBE were measured in evaporative tests. From exhaust tests, ethylene, 1,3-butadiene, isobutylene, benzene, toluene, xylenes, formaldehyde, acetaldehyde, ethanol, MTBE, and nitrous oxide emissions were quantified.

A procedure for measuring MTBE emissions was also developed, validated, and qualified for this program. The analytical procedure allows for the determination of MTBE in Tedlar sample bags.

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*Numbers in parentheses designate references at the end of this report.

II. FUELS, VEHICLES, AND TEST PROCEDURES

This section of the report includes descriptions of the fuels, vehicles, test equipment, and instrumentation used in this program. Emission test procedures and calculation methods are also described.

A. Test Fuels

Four fuels were used for emissions evaluations; three were oxygenated gasoline blends and one was an aromatic-enriched gasoline. The four fuels were prepared by the addition of the respective oxygenate or toluene-xylene mixture to a base gasoline fuel. Test fuel characteristics were specified in the spring of 1989, and they are not necessarily representative of fuels that could or would be produced in the future under current or proposed legislation. Procurement specifications for the base fuel (which was obtained from Phillips 66 Company) were that it be a commercially available unleaded gasoline, with an octane number of 87 (R+M)/2, that it contain 20- to 30-percent aromatics, and have a Reid Vapor Pressure (RVP) of 9.0 to 10.0 psi. The test fuels were prepared to yield comparable octane numbers and RVPs (the ethanol blend was allowed a 1 psi higher RVP). Fuel compositions and properties of the base fuel and the four test fuels are given in Table 1. Note that the base fuel was used only as a blending stock for all the test fuels. It was not tested itself. The fuel used for comparison to the oxygenates is referred to as the baseline fuel (Fuel 1) which consisted of the base fuel plus aromatics.

The benzene content of the base fuel was determined to be lower than the desired 1 to 2 percent. To achieve the desired benzene content in the blends, benzene was added to Fuel 1, the aromatic-enriched baseline fuel to achieve a benzene concentration of 1.5 volume percent (analyzed as 1.6 volume percent). In addition, the other three fuels (10 percent ethanol blend, 16.4 percent MTBE blend, and 19.1 percent ETBE blend) were adjusted to 1.5 volume percent benzene "in the gasoline portion" of the blend. The addition of butane and/or oxygenates to these blends gave lower actual concentrations of benzene. The calculated benzene levels in Fuels 2, 3, and 4 are 1.35, 1.24, and 1.16 volume percent, respectively. The four test fuels, which were prepared from the base fuel, are described below.

Fuel	Description
1	Aromatic-enriched baseline fuel - 35.5% aromatics
2	10% ethanol blend (3.5% oxygen, 22.8% aromatics)
3	16.4% MTBE blend (3.0% oxygen, 20.4% aromatics)
4	19.1% ETBE (3.0% oxygen, 18.4% aromatics)

The MTBE and ETBE fuels were blended to yield oxygen contents of 3 percent each and the ethanol fuel was prepared for a 3.5 percent oxygen content. The relatively high oxygen content of the ether blends (above that presently allowed by EPA regulations) provided the greatest possible chance of observing an effect on unregulated emissions.

Blending of the test fuels involved the prior preparation of two sets of trial blends. In the first trial, one-gallon volumetric blends were made of the base gasoline combined with each of the four blending components as described above. Composition and properties of these blends are listed in Table

TABLE 1. COMPOSITION AND PROPERTIES OF GASOLINE TEST FUELS

Product			Fuel 1	Fuel 2	Fuel 3	Fuel 4
Fuel No.		Base Fuel	EM-905-F	EM-906-F	EM-907-F	EM-908-F
Composition, Vol. %						
Base		100.0	81.9	89.4	77.2	64.7
Aromatic Mix[a]		--[b]	14.6	--	--	--
Ethanol		--	--	9.9	--	--
MTBE		--	--	--	16.4	--
ETBE		--	--	--	--	19.1
Straight Run Naphtha		--	--	--	4.7	12.2
N-Butane		--	2.6	--	1.1	3.4
Added Benzene		--	0.9	0.7	0.6	0.6
TOTAL		100.0	100.0	100.0	100.0	100.0
Properties	**Test Method**					
Gravity, °API	D 1298	61.5	57.1	60.5	61.2	61.7
Specific Gravity, 60°F		0.7332	0.7503	0.7370	0.7343	0.7324
Density, lb/gal (g/mL)		6.11(0.73)	6.25(0.75)	6.14(0.74)	6.12(0.73)	6.10(0.73)
Distillation, °F (°C)	D 86					
IBP		107(42)	82(28)	92(33)	88(31)	94(34)
5		c	100(38)	110(43)	105(40)	112(44)
10		125(52)	121(49)	122(50)	120(49)	128(53)
20		c	161(72)	139(59)	143(62)	154(68)
30		185(85)	194(90)	150(66)	162(72)	174(79)
40		c	216(102)	161(72)	181(83)	188(87)
50		224(107)	229(109)	209(98)	199(93)	201(94)
60		c	240(1160	229(109)	218(103)	215(102)
70		255(124)	254(123)	247(119)	239(115)	234(112)
80		c	273(134)	267(131)	264(129)	258(126)
90		336(169)	306(152)	311(155)	305(152)	301(149)
95		c	340(171)	347(175)	343(173)	333(167)
FBP		423(217)	406(208)	405(207)	398(203)	398(203)
Reid Vapor Pressure, psi	D 323	9.05	9.50	10.15[d]	9.45	9.15
Hydrocarbon Type, Vol. %	D 1319					
Aromatics[e]		24.7[f]	35.1(35.5)[f]	22.8	20.4	18.4
Olefins[e]		8.2[f]	6.8(6.1)[f]	7.3	6.4	5.4
Saturates[e]		67.1[f]	58.1(58.4)[f]	60.0	56.8	57.2
Benzene Content, Vol. %	D 3606	0.7	1.6	1.35[g]	1.24[g]	1.16[g]
Octane						
Research	D 2699	91.1	94.6	95.0	94.6	94.2
Motor	D 2700	82.4	84.4	84.2	84.5	85.0
R+M/2		86.8	89.5	89.6	89.6	89.6

[a] 50/50 toluene/mixed xylenes

[b] -- Indicates component not added to fuel.

[c] Not measured.

[d] Used D4953 (dry method) to measure RVP of ethanol blend.

[e] Calculated values except as indicated (hydrocarbon type not measured for Fuels 2, 3, and 4 because oxygenates interfere with analysis).

[f] Measured values.

[g] Calculated values.

TABLE 2. COMPOSITION AND PROPERTIES OF FIRST SET OF TRIAL GASOLINE BLENDS

Product		Base	Blend 1	Blend 2	Blend 3	Blend 4
Fuel No.		FL-1478-G	FL-1481-G	FL-1482-G	FL-1483-G	FL-1484-G
Composition, Vol. %						
Base		100.0	85.7	90.0	83.5	80.8
Aromatic Mix		--[a]	14.3	--	--	--
Ethanol		--	--	10.0	--	--
MTBE		--	--	--	16.5	--
ETBE		--	--	--	--	19.2
TOTAL		100.0	100.0	100.0	100.0	100.0
Properties	**Test Method**					
Gravity, °API	D 1298	61.5	56.1	60.0	60.8	60.4
Specific Gravity, 60°F		0.7332	0.7543	0.7389	0.7358	0.7374
Density, lb/gal		6.1060	6.2818	6.1536	6.1277	6.1411
Distillation, °F	D 86					
IBP		107	100	100	96	96
10		125	136	127	131	140
30		185	202	152	164	179
50		224	232	210	202	204
70		255	260	248	242	236
90		336	322	323	316	310
FBP		423	420	408	408	424
Reid Vapor Pressure, psi	D 323	9.05	7.80	9.90	8.75	7.95
Hydrocarbon Type, Vol. %	D 1319					
Aromatics		24.7	34.5	b	b	b
Olefins		8.2	7.0	b	b	b
Saturates		67.1	58.5	b	b	b
Octane						
Research	D 2699	91.1	94.4	95.9	95.6	96.9
Motor	D 2700	82.4	84.0	84.2	85.3	86.8
R+M/2		86.8	89.2	90.1	90.5	91.8

[a] -- Indicates component not added to blend.

[b] Not measured, oxygenates interfere with FIA method.

2 for comparison with the base gasoline in the first column. As anticipated, the aromatics content of Blend 1 was 9.8 volume percent higher than the base fuel (34.5% versus 24.7%). The ethanol in Blend 2 caused an increase in Reid Vapor Pressure (RVP) of 0.85 psi (9.90 versus 9.05 psi). The RVP of Blends 1, 3, and 4 decreased by varying amounts. Additionally, all four components raised the octane numbers of the blends.

The results from the first trial blends allowed calculation of blending values of the components with the following results:

Blending Property	Aromatics	Ethanol	MTBE	ETBE
RVP, psi	0.3	17.6	6.7	3.4
Research Octane	114.2	139.1	118.0	121.3
Motor Octane	93.6	100.4	100.0	104.3
(R+M)/2	103.9	119.8	109.0	112.8

These values were used in calculating compositions of the second set of trial blends. No change in RVP was contemplated for Blend 2 (with ethanol) because current EPA regulations allow a 1 psi increase in RVP for ethanol blends over maximum summer RVP limits. For the other three blends, the objective was to adjust RVP values to between 9.0 and 10.0 psi and octane numbers to between 89.0 and 90.0 (R+M)/2. Adjustment of Blend 1 could be done by addition of normal butane, which would increase both RVP and octane. Blends 3 and 4, containing MTBE and ETBE, respectively, would require the addition of normal butane to raise RVP plus another component to reduce octane. To reduce the octane in Blends 3 and 4, a low-octane component was prepared by blending light and heavy straight run naphthas to make a product with a distillation curve similar to the base gasoline. One gallon each of Blends 1A, 3A, and 4A were made and tested. Results in Table 3 show that objectives were met with RVP's of 9.2 to 9.3 psi and octane numbers of 89.3 to 89.9 (R+M)/2. Thirty six gallons of the straight run naphtha blend were made for use in the test fuel blends. Physical properties of the naphtha blend were measured, and the results are also included in Table 3.

After preparing the two sets of trial blends and measuring their physical properties, the test fuel blends were made with the same compositions as in Table 3 except that Fuel 4 was modified to reduce the octane slightly. A total of 350 gallons of Fuel 1 and 200 gallons of each of the other three fuels were prepared for emissions testing. Blends were made by weighing each component into a 500-gallon stainless steel tank and mixing by circulation. As previously mentioned, benzene was added to three of the four blends to adjust the benzene concentration "in the gasoline portion" of blend to 1.5 volume percent. This adjustment gave benzene volume percent concentrations for Fuels 1 through 4 of 1.6 (measured), 1.35 (calculated), 1.24 (calculated), and 1.16 (calculated), respectively. Fuels were transferred into drums, sealed, and stored in a refrigerated room at 40°F. Laboratory analyses of the four test fuels are given in Table 1. Reid vapor pressures were between 9.15 and 9.50 psi for Fuels 1, 3, and 4. Fuel 2, which is a "splash blend" of 10 volume percent ethanol, had a vapor pressure of 10.15 psi. This vapor pressure is 1.10 psi above the base fuel (9.05 psi). The octane numbers of the four fuels ranged from 89.5 to 89.6 (R+M)/2, equivalent to unleaded midgrade gasolines. The fuels met the blending objectives and were well matched for RVP and octane.

TABLE 3. COMPOSITION AND PROPERTIES OF SECOND SET OF TRIAL GASOLINE BLENDS AND STRAIGHT RUN NAPHTHA

Product		Blend 1A	Blend 3A	Blend 4A	SR Naphtha
Fuel No.		FL-1489-G	FL-1490-G	FL-1491-G	FL-1498-G
Composition, Vol. %					
Base		82.7	77.7	66.6	--
Aromatic Mix		14.7	--	--	--
MTBE		--[a]	16.5	--	--
ETBE		--	--	19.2	--
Straight Run Naphtha		--	4.7	10.9	100.0
N-Butane		2.6	1.1	3.3	--
TOTAL		100.0	100.0	100.0	100.0
Properties	**Test Method**				
Gravity, °API	D 1298	57.2	60.6	61.7	57.9
Specific Gravity, 60°F		0.7499	0.7366	0.7324	0.7471
Density, lb/gal		6.2452	6.1344	6.0994	6.219
Distillation, °F	D 86				
IBP		81	83	90	123
10		120	115	135	173
30		195	160	172	204
50		227	196	200	229
70		255	231	231	257
90		307	306	299	295
FBP		404	396	394	354
Reid Vapor Pressure, psi	D 323	9.30	9.20	9.20	3.80
Hydrocarbon Type, Vol. %	D 1319				
Aromatics		33.3	b	b	15.1
Olefins		6.9	b	b	0.5
Saturates		59.8	b	b	84.4
Octane					
Research	D 2699	94.5	94.6	94.7	64.1
Motor	D 2700	84.0	84.6	85.0	61.1
(R+M)/2		89.3	89.6	89.9	62.6

[a] -- Indicates component not added to blend.

[b] Not measured, oxygenates interfere with FIA method.

B. Test Vehicles

Five light-duty gasoline vehicles were tested in the program, one from each of the following targeted categories:

Vehicle Category	Model Year and Emissions Equipment
1	pre 1975, non-catalyst
2	1975 to 1978, oxidation catalyst, air pump
3	1980 to 1983, 3-way catalyst, closed-loop carburetor, air pump
4	1983 to 1990, 3-way catalyst, throttle body fuel injection, no air injection
5	1983 to 1990, 3-way catalyst, port (multi-point) fuel injection, no air injection

All test vehicles had a minimum of 5,000 miles on the odometer. Descriptions of the vehicles are given in Table 4 and photographs are provided in Figure 1. No adjustments to the test vehicle engines were made prior to testing. Each vehicle was initially operated over a Federal Test Procedure (FTP) cycle for the measurement of regulated exhaust emissions. Upon acceptance of the initial emissions results by the EPA Project Officer, based on emissions being in the range typical of in-use vehicles, each vehicle was tested for both regulated and several unregulated exhaust and evaporative emissions using the four test fuels.

C. Test Procedures and Equipment

Regulated gaseous emission tests conducted on the vehicles were performed following the appropriate Federal Regulations applicable to light-duty gasoline vehicles.(1) Sampling and analysis of unregulated emissions were conducted according to procedures discussed in a subsequent section of this report. Evaporative emissions were collected in Tedlar bags from a sealed housing for evaporative determinations (SHED) for hydrocarbon speciation.

1. Dynamometer and CVS System

A Clayton Model ECE-50 chassis dynamometer with a direct-drive variable-inertia flywheel system was used for the testing. The direct-drive inertia system simulates equivalent weight of vehicles from 1000 to 4875 lbs in 125 lb increments.

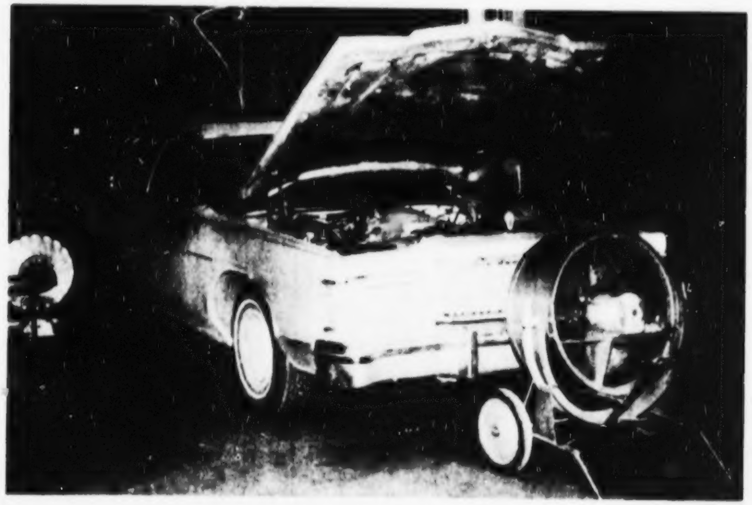
The constant volume sampler (CVS) used for the evaluations was SwRI CVS No. 2. An 18-inch diameter by 16-foot long stainless steel dilution tunnel was used in conjunction with the CVS, which was run at a nominal 315 scfm. This flowrate generally provided tunnel sampling zone temperatures not exceeding 110°F during the FTP cycles. Partial views of the dynamometer, CVS, and dilution tunnel can be seen in Figure 2. Dimensional details of the dilution tunnel are provided in Figure 3.

TABLE 4. DESCRIPTION OF TEST VEHICLES

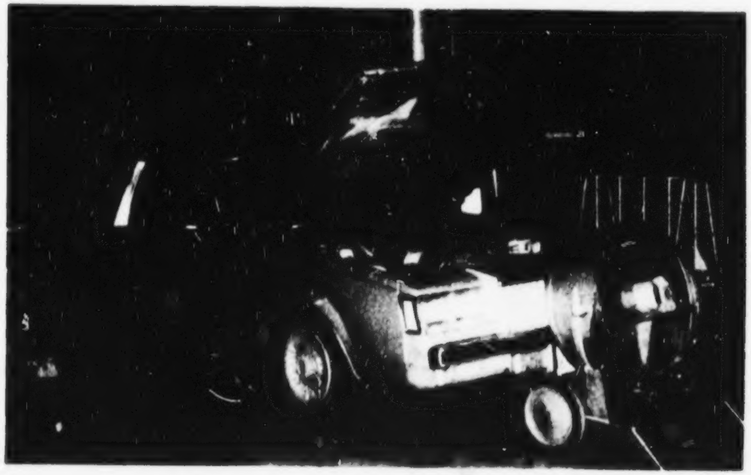
Vehicle No.	1	2	3
Vehicle Category	4	2	3
Make and Model	Chevrolet Lumina	Mercury Marquis	Buick Regal
Model Year	1990	1977	1983
Body Type	4-Door	4-Door	2-Door
Transmission Type	A-3	A-3	A-3
Cylinders	I-4	V-8	V-6
Displacement, L	2.5	6.6	3.8
Odometer Miles	5255	81,679	83,007
Engine Family	LIG2.5V5TPG6LB0-IE	351M/400-"B"-(2CV1)	D4G3.8V2NEA3
VIN	2G1WL54R2L9115757	7Z635605324	1G4AM47A4DH593781
Chassis Dynamometer Inertia Setting, lbs Road Load, hp @ 50 mph	 3500 5.6	 4500 14.0	 4000 11.3

Vehicle No.	4	5
Vehicle Category	1	5
Make and Model	Chevrolet Impala	Ford Probe
Model Year	1974	1990
Body Type	4-Door	2-Door
Transmission Type	A-3	A-3
Cylinders	V-8	V-6
Displacement, L	5.7	3.0
Odometer Miles	62,739	11,538
Engine Family	XZ GM104-2	LFM3.0V5FEG1
VIN	1L69H4S133120	1ZVPT21U7L5133099
Chassis Dynamometer Inertia Setting, lbs Road Load, hp @ 50 mph	 4875 14.7	 3750 8.1

Vehicle 1 - 1990 Chevrolet Lumina

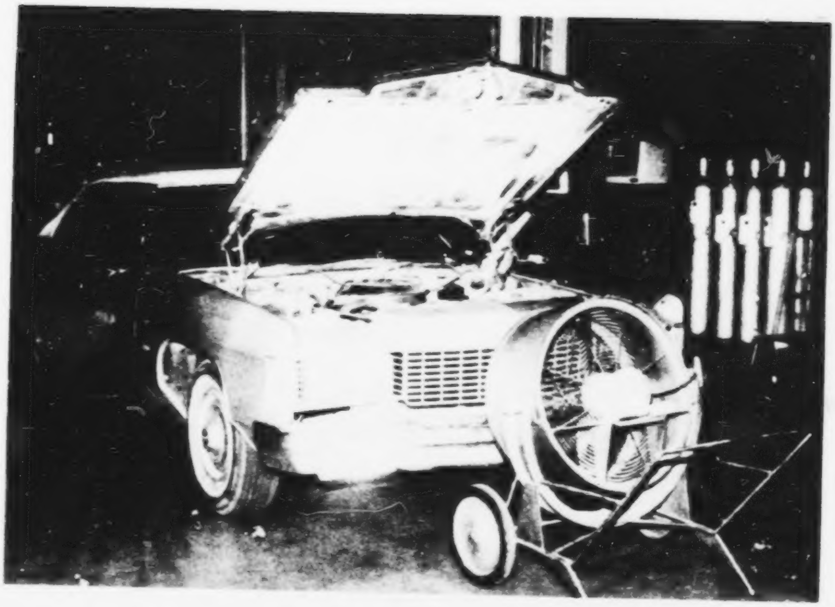


Vehicle 2 - 1977 Mercury Marquis

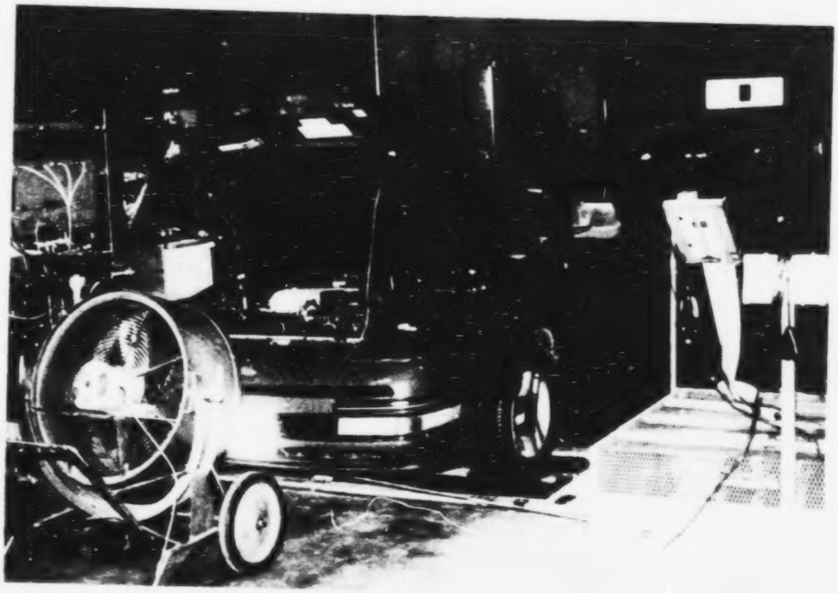


Vehicle 3 - 1983 Buick Regal

FIGURE 1. TEST VEHICLES

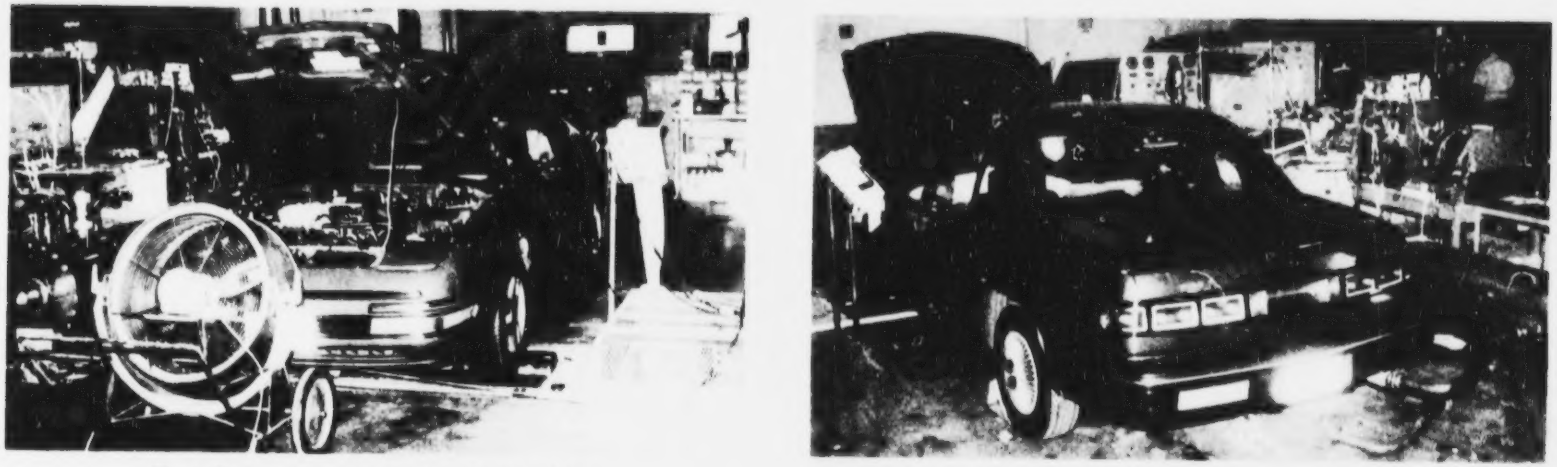


Vehicle 4 - 1974 Chevrolet Impala



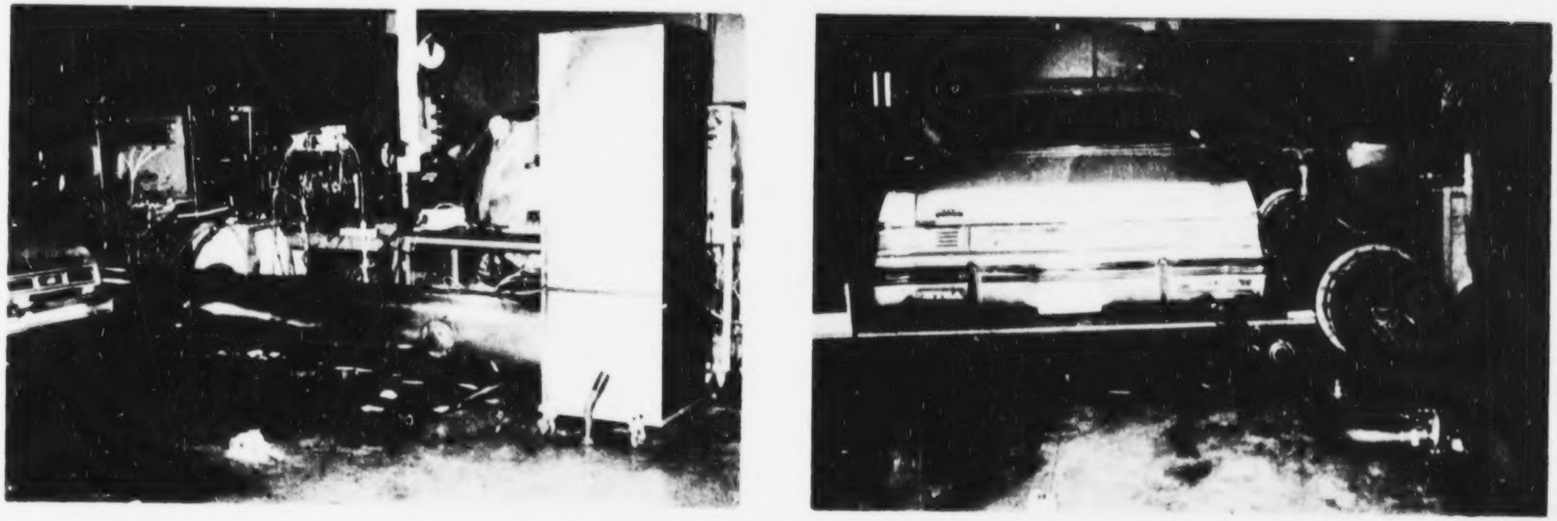
Vehicle 5 - 1990 Ford Probe

FIGURE 1 (CONT'D). TEST VEHICLES



Test Car on Dynamometer Rolls with Inertia Weights in View

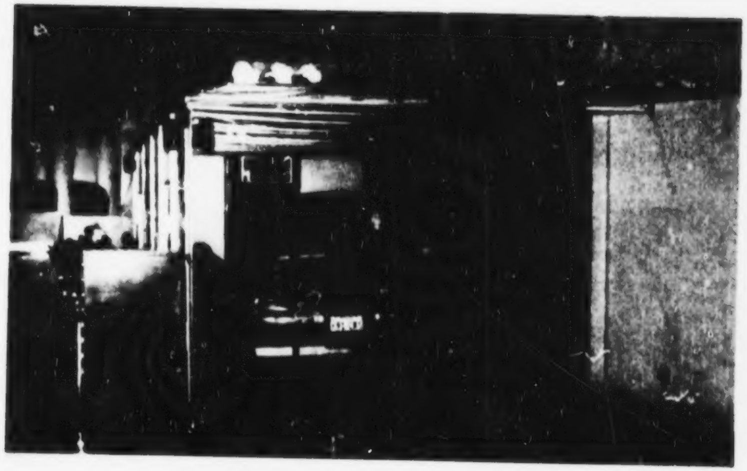
Driver Following FTP Trace



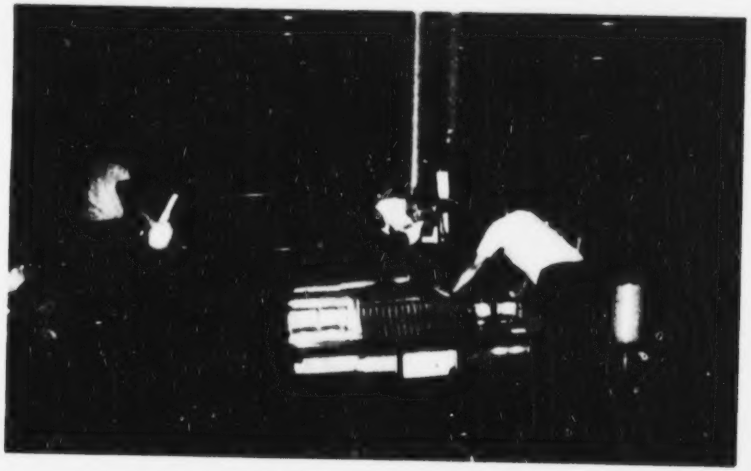
Dilution Air Box and Tunnel

Rear Wheel Drive Vehicle Attached to Dilution Tunnel

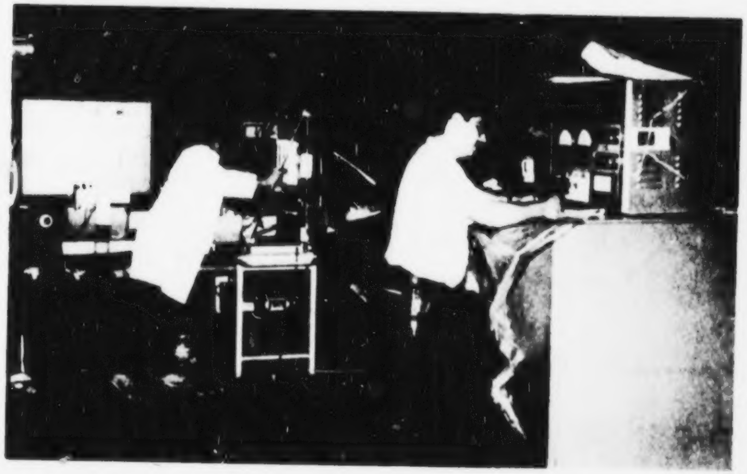
FIGURE 2. EMISSIONS SAMPLING SYSTEM



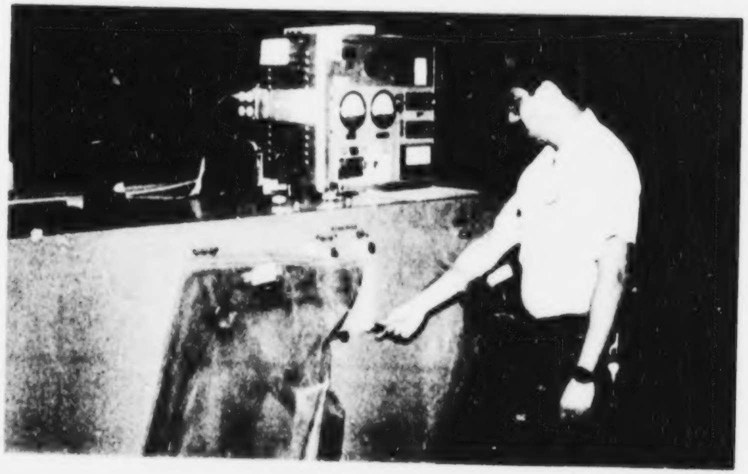
Test Vehicle in Evaporative SHED



Test Vehicle Being Pushed onto Dynamometer



CVS Unit with Unregulated Emissions Sampling



Gaseous Emissions Sampling into Tedlar Bags

FIGURE 2 (CONT'D). EMISSIONS SAMPLING SYSTEM

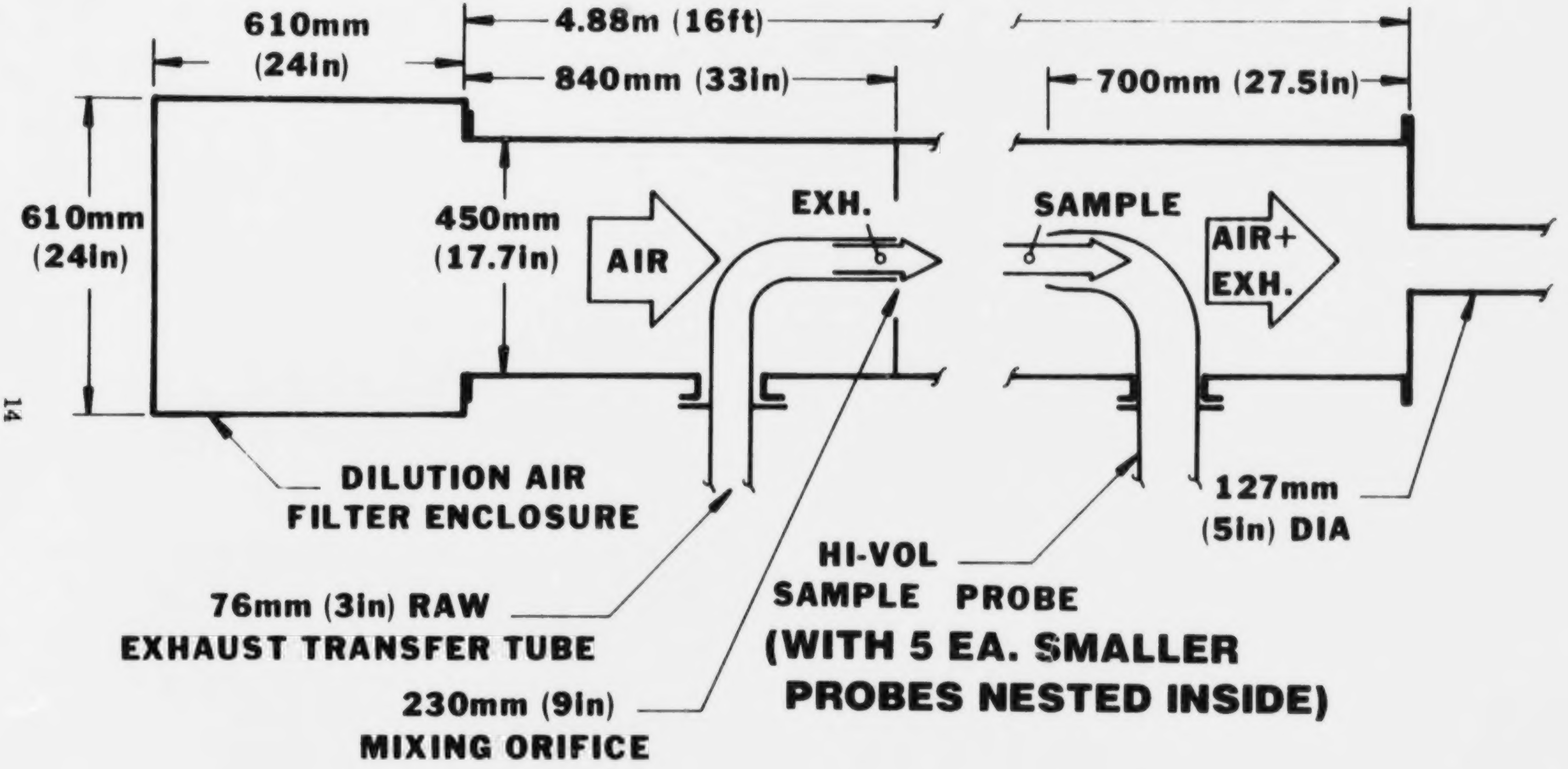


FIGURE 3. DIMENSIONAL SCHEMATIC OF DILUTION TUNNEL

2. Engine Cooling at Dynamometer

A cooling fan of 5000 cfm capacity was used in front of the vehicle during all test cycles. The hood was maintained fully open during all cycles and was closed during the soak periods.

3. Exhaust Emission Sampling

Exhaust sampling was conducted using the system shown schematically in Figure 4. The system was used in accordance with the guidelines established in various studies(2,3,4,5) conducted at SwRI for the EPA.

The major difference between this system and similar systems used in other projects is the number of sampling probes and systems required to collect unregulated emissions samples. More details on each of the individual sampling systems for unregulated emissions are given in a later section of this report.

4. Evaporative Emission Sampling

FTP evaporative emission tests, including the diurnal breathing loss test and the hot-soak evaporative emission test, were conducted using the SwRI evaporative emission enclosure (SHED). Evaporative hydrocarbon emission analyses were conducted using a Beckman Model 400 Analyzer.

For the measurement of unregulated evaporative emissions, samples were collected from the SHED in Tedlar bags at the beginning (background) and end (sample) of each diurnal and hot-soak test. These Tedlar bags were then analyzed for MTBE, benzene, and ethanol.

5. Instrumentation for Regulated Emissions

The bagged gaseous emissions obtained at the CVS were analyzed for HC, CO, NO_x, and CO_2. The emissions were evaluated using SwRI Bag Cart Number 2. This bag cart was designed, calibrated, and operated in accordance with the appropriate sections of the Code of Federal Regulations for light-duty vehicles.(1)

6. Test Procedures

The test vehicles were evaluated over the Federal Test Procedure (FTP). The FTP, as specified in the Federal Register, consists of a Diurnal Breathing Loss Test (DBL), a Hot Soak Loss Test (HSL), and a dynamometer driving schedule with cold-start and hot-start, multi-cycle with multi-segment operation. The dynamometer segment of the FTP uses the Urban Dynamometer Driving Schedule (UDDS, Figure 5) which is 1372 seconds in duration. The UDDS, in turn, is divided into two segments; the first 505 seconds and the second 867 seconds. The FTP consists of a cold-start 505 and stabilized 867, followed by a ten-minute soak and then a hot-start 505. Cycle duration, distance driven, and average speed of the FTP are given in Table 5. In this project, a test schedule was used not only to accommodate the dynamometer and evaporative procedure as specified in the Code of Federal Regulations for the FTP, but also to provide a four-cycle FTP for sampling of the exhaust unregulated emissions (aldehydes and ketones and ethanol). The four-cycle extended test schedule is identified in Table 6.

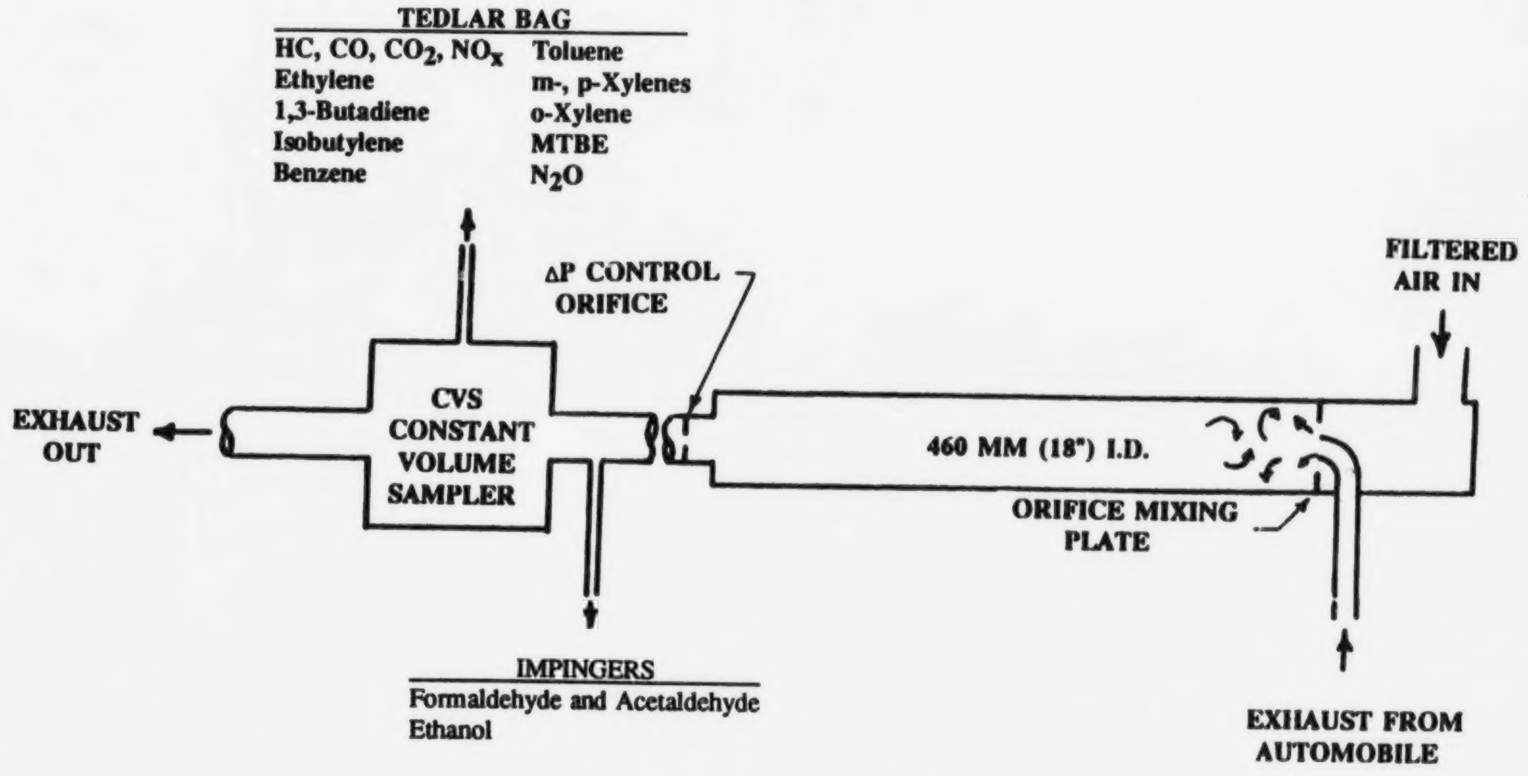


FIGURE 4. EMISSIONS SAMPLING SYSTEM

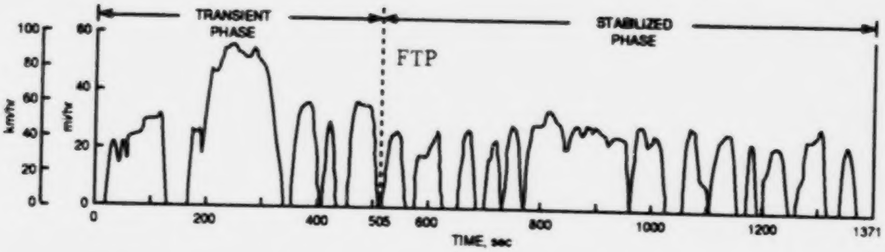


FIGURE 5. FTP DRIVING SCHEDULE, SPEED VS TIME

TABLE 5. SUMMARY OF DRIVING SCHEDULE PARAMETERS

	Duration, Seconds	Distance, Miles	Average Speed, mph
FTP			
505	505	3.60	25.7
867	867	3.85	16.2
UDDS	1372	7.45	19.5

TABLE 6. EXTENDED FTP TEST SCHEDULE

	Evap. DBL	Cold 505	Stab. 867	10-min. Soak	Hot 505	Evap. HSL	Hot 505	Stab. 867
Regulated Emissions	X^a	X	X		X	X		
Unregulated Emissions								
Speciated Hydrocarbons:								
Ethylene		X	X		X			
1,3-Butadiene		X	X		X			
Isobutylene		X	X		X			
Benzene	X	X	X		X	X		
Toluene		X	X		X			
m-, p-Xylenes		X	X		X			
o-Xylene		X	X		X			
Oxygenated Hydrocarbons and N_2O:								
Formaldehyde		X_1	X_1		X_2			X_2
Acetaldehyde		X_1	X_1		X_2			X_2
Total Aldehydes & Ketones		X_1	X_1		X_2			X_2
Ethanol	X	X_3	X_3		X_4	X		X_4
MTBE[b]	X	X	X		X	X		
Nitrous oxide		X	X		X			

[a] X designates a sample taken, an X with the same subscript is the same sample.
[b] MTBE - methyl tertiary butyl ether.

The last hot-start 505 and stabilized 867 of the four-cycle extended FTP test schedule allowed for sampling of aldehydes and ketones and ethanol, which was started during the hot-start 505 of the FTP to be completed during the stabilized 867 segment. This UDDS cycle was also used for prepping the test vehicle for repeat FTP tests when testing with the same fuel on the following day.

7. Calculations

A composite value in mass per distance for the three-cycle, three-sample FTP for regulated emissions and unregulated emissions collected in bags is calculated using the following formula:

$$\frac{MASS}{DISTANCE} = \frac{0.43\times\ (MASS\ 1\ +\ MASS\ 2)}{(DIST.\ 1\ +\ DIST.2)} + \frac{0.57\times\ (MASS\ 3\ +\ MASS\ 2)}{(DIST.\ 3\ +\ DIST.\ 2)}$$

Assuming Distance 3 is equal to Distance 1, this equation can be reduced to:

$$3\text{-}Bag\ FTP\ M/D = \frac{0.43\times(M1+M2)+0.57\times(M3+M2)}{D1+D2}$$

For the four-bag, two-sample FTP, composite values for aldehydes and ketones and ethanol emissions are calculated using the following formula:

$$\frac{MASS}{DISTANCE} = \frac{0.43\times(M1+M2)}{(D1+D2)} + \frac{0.57\times(M3+M4)}{(D3+D4)}$$

Assuming Distance 3 is equal to Distance 1 and Distance 4 is equal to Distance 2, then this equation can be reduced to:

$$4\text{-}Bag\ FTP\ M/D = \frac{0.43\times(M1+M2)+0.57\times(M3+M4)}{D1+D2}$$

Therefore, with the assumption that the changes in distance traveled are negligible, the composite results with the four-cycle FTP relative to results with the three cycle FTP will differ only as the mass emissions emitted during Cycle 4 differ from those emitted during Cycle 2.

III. ANALYTICAL PROCEDURES AND MTBE PROCEDURE DEVELOPMENT

Unregulated emissions were sampled and analyzed by several methods. Table 7 provides a description of sampling and analysis methods for these compounds. Detailed descriptions of the procedures used for measuring ethylene, 1,3-butadiene, isobutylene, benzene, toluene, and nitrous oxide, along with discussions of their development, validation, and qualification, are available in the following EPA reports: "Analytical Procedures for Characterizing Unregulated Emissions from Motor Vehicles," EPA Report EPA-600/2-79-017(2); and "Butadiene Measurement Technology," EPA Report EPA 460/3-88-005.(3) A detailed procedure for the measurement of ethanol and aldehydes and ketones in exhaust is provided in the CRC report, "Characterization of Exhaust Emissions from Alcohol-Fueled Vehicles," Project CAPE-30-81.(4)

TABLE 7. SAMPLING AND ANALYSIS METHODS FOR UNREGULATED EMISSIONS

Compounds	Sampling	Analysis
Ethylene Benzene Toluene	Tedlar Bag	GC/FID[a]
1,3-Butadiene Isobutylene	Tedlar Bag	GC/FID[b]
m-, p-Xylenes o-Xylene MTBE	Tedlar Bag	GC/FID[c]
Formaldehyde Acetaldehyde	Impinger with acidified DNPH	HPLC/UV
Ethanol	Impinger with deionized water	GC/FID[d]
Nitrous oxide	Tedlar Bag	GC/ECD

[a,b,c,d] Different GC/FID units with specific columns, carrier flowrates, etc. for the desired analysis.

A hydrocarbon speciation procedure was adapted for the measurement of methyl tertiary butyl ether (MTBE) in exhaust and in evaporative emissions. A series of validation and qualification experiments were performed with MTBE as part of the procedural development. The results of these tests are reported in this section. Brief descriptions of the sampling and analytical procedures for other unregulated emission measurements are also given in this section.

The program, as initially planned, did not include a test fuel containing ETBE. When the ETBE containing fuel was added to the program, no existing analytical methods were available for emission analyses. Since the development of an analytical method for ETBE was beyond the scope of this program, no ETBE emission measurements were conducted in this study.

A. Analytical Procedures

Ethylene, Benzene, and Toluene - Dilute exhaust emissions were sampled in Tedlar bags and analyzed by a gas chromatograph (GC) with a flame ionization detector. The compounds that were analyzed included ethylene (C_2H_4), benzene (C_6H_6), and toluene (C_7H_8). Five additional compounds can also be evaluated by this procedure. They are methane, ethane, acetylene, propane, and propylene. The GC system is equipped with four separate packed columns which are used to resolve the individual compounds. A system of timers, solenoid valves, and gas sampling valves directs the flow of the sample through the system. The carrier gas is helium. Peak areas are compared to an external calibration blend and the hydrocarbon concentrations are obtained using a Hewlett-Packard 3353 computer system. Minimum detection limits for C_1 to C_3 compounds, benzene, and toluene are 0.05 ppmC.

1,3-Butadiene and Isobutylene - The procedure was developed to measure 1,3-butadiene in dilute vehicle exhaust. Six other compounds can also be measured by this procedure including isobutylene, isobutane, butane, 1-butene, cis-2-butene, and trans-2-butene. Only 1,3-butadiene and isobutylene were quantified in this study. Standard CVS bag samples were analyzed for the C_4 compounds using a Perkin-Elmer Model 3920B gas chromatograph equipped with a flame ionization detector (FID), two pneumatically-operated and electrically-controlled Seiscor valves, and an analytical column. The analytical column measures 9 ft x 1/8-in., and is stainless steel containing 80/100 Carbopack C with 0.19% picric acid. The helium carrier gas flows through the column at a rate of 27 mL/min. The column temperature is maintained at 40°C for analysis. External standards in zero air are used to quantify the results. Detection limits for the procedure are on the order of 0.03 ppmC.

MTBE and o-, m-, and p-Xylenes - This hydrocarbon speciation procedure permits the quantitative determination of more than 80 individual hydrocarbon species in automotive emissions. The compounds targeted for this program included MTBE and the three xylene isomers. Two of the xylene isomers, m- and p-xylene, were not separated from each other in the analyses and were quantified together. The gas chromatograph system utilizes a Perkin-Elmer Model 3920B gas chromatograph equipped with subambient capabilities, a capillary column, and a flame ionization detector. The capillary column used in the system is a Perkin-Elmer F-50 Versilube, 150-ft x 0.02-in. WCOT stainless steel column. The column is initially cooled to -139°F (-95°C) for sample injection. Upon injection, the temperature is programmed at a 7°F (4°C) increase per minute to 185°F (85°C). Column temperature is held at 185°F for approximately 15 minutes to complete column flushing. A flow controller is used to maintain a 1.5 mL/min helium carrier flow rate. The 10 mL sample volume permits the determination of 0.1 ppmC of each hydrocarbon component with the flame ionization detector.

Aldehydes and Ketones - The measurement of formaldehyde and acetaldehyde in exhaust is accomplished by bubbling dilute exhaust at 4 L/min through chilled glass impingers containing an acetonitrile solution of 2,4-dinitrophenylhydrazine (DNPH) and perchloric acid. The exhaust sample is collected continuously during the test cycle. For analysis, a portion of the acetonitrile solution is injected into a high pressure liquid chromatograph (HPLC) equipped with a UV detector. The HPLC system uses a 25 cm x 4.6 mm analytical column packed with Zorbax ODS. Flowrate of the mobile phase, acetonitrile-water (72:28), is 0.3 mL/min. The concentration of acetonitrile is increased to 100 percent acetonitrile at the rate of 1 percent per minute. External standards of the aldehyde and ketone DNPH derivatives are used to quantify the results. Detection limits for this procedure are on the order of 0.005 ppm of formaldehyde or acetaldehyde in dilute exhaust.

Ethanol - Ethanol is sampled by bubbling dilute exhaust through chilled glass impingers at a nominal flowrate of 4 L/min. Water is used as the trapping medium in the impingers. After sampling, a portion of the water solution is analyzed directly by gas chromatography using a flame ionization detector. The analytical column is a 3 foot x 1/8 inch Teflon column packed with 120/150 mesh Porapak Q. The carrier gas is helium. External ethanol standards are used for quantitation of ethanol in the samples. The detection limit for this procedure is approximately 0.06 ppm ethanol in dilute exhaust.

Nitrous Oxide - Dilute exhaust is sampled for nitrous oxide into a Tedlar bag. A sample from the bag is analyzed with a gas chromatograph (GC) equipped with an electron capture detector. The GC utilizes a stripper column (to trap heavier molecular weight exhaust species) and a 6 foot x 1/8 inch stainless steel analytical column packed with 80/100 mesh Porapak Q. The carrier gas is a blend of methane-argon (5:95). External standards are analyzed for quantitation of sample responses. Nitrous oxide can be measured at concentrations as low as 0.01 ppm in dilute exhaust using this method.

B. MTBE Procedure Development

A C_5 - C_{10} hydrocarbon speciation procedure was adapted for the analysis of methyl tertiary-butyl ether (MTBE). The analytical procedure is described in a previous subsection. Several tests were conducted to validate and qualify the method to be used for the analysis of MTBE. The tests included recovery of MTBE from the CVS dilution tunnel (no car), from injection into the exhaust of a vehicle, and from the evaporative SHED. In addition, MTBE bag memory, injection repeatability, and stability in a bag of exhaust were determined. A linear response of the flame ionization detector was demonstrated over the expected range of MTBE concentrations.

MTBE recoveries from the CVS tunnel alone and from the CVS tunnel with the exhaust of a vehicle are reported in Tables 8 and 9. The average recovery of MTBE from the CVS tunnel alone (six tests) was 70 percent. The average recovery of MTBE from the CVS tunnel with exhaust present (also six tests) was 80 percent. In these recovery experiments, MTBE was introduced into the CVS dilution tunnel or into the exhaust of a vehicle at about 0.12 mL/min. The flowrate of the CVS was 320 cfm. In the tunnel recovery tests, a bag sample was taken over six 23-minute time periods. In the exhaust recovery tests, a 1990 Chevrolet Lumina (first test car in this program) was operated on Howell EEE over three hot-start UDDS cycles. Bag samples of dilute exhaust were taken over the first 505 seconds and over the next 867 seconds of each cycle. Recovery of MTBE was calculated relative to the amount of MTBE injected into the CVS tunnel or exhaust.

TABLE 8. RECOVERY OF MTBE FROM INJECTION INTO THE DILUTION TUNNEL

Date	MTBE Recovered, ppmC	MTBE Injected, Calculated ppmC	CVS Tunnel Recovery, %
1-16-90	7.68	13.41	57.3
	9.02	13.41	67.3
	8.96	13.41	66.8
1-24-90	9.96	13.41	74.3
	10.53	13.41	78.5
	10.47	13.41	78.1
Avg.			70

TABLE 9. RECOVERY OF MTBE FROM INJECTION INTO THE EXHAUST OF A VEHICLE

Date	Test	MTBE Recovered, ppmC	MTBE Injected, Calculated ppmC	Exhaust Recovery, %
1-25-90	Hot Start 505 #1	10.30	13.41	76.8
	Hot Start 867 #1	10.03	13.41	74.8
	Hot Start 505 #2	11.54	13.41	86.1
	Hot Start 867 #2	11.27	13.41	84.0
	Hot Start 505 #3	10.54	13.41	78.6
	Hot Start 867 #3	10.64	13.41	79.4
Avg.				80

MTBE recovery from the evaporative SHED was also determined. For each of the recovery tests, the mass of approximately 20 mL of MTBE was measured in a 50 mL beaker. The beaker was placed on a hot plate in the evaporative SHED, the SHED was sealed, and the MTBE was allowed to evaporate over a one-hour time period. Tedlar bag samples were taken at the start and completion of each test. The concentration of MTBE was measured using the C_5 to C_{10} hydrocarbon speciation method. The average MTBE recovery from the SHED was 82 percent. Individual test results are given in Table 10.

TABLE 10. RECOVERY OF MTBE FROM THE EVAPORATIVE SHED

Test No.	MTBE Recovered, g	MTBE Evaporated Into SHED, g	Evaporative SHED Recovery, %
1	11.86	14.70	80.7
2	11.79	14.64	80.5
3	12.34	14.63	84.3
Average			82

The 82 percent average SHED MTBE recovery compares with a 70 percent recovery from the CVS tunnel and 80 percent recovery from the exhaust of a vehicle. The reported emission test results are not adjusted for these recoveries.

Another experiment was conducted to determine if Tedlar bags retain an MTBE "memory." A Tedlar bag, filled with 2 ft^3 of zero air, was injected with 10 µL of MTBE (about 180 ppmC MTBE). The bag was analyzed for MTBE, evacuated, and filled with zero air. The bag was then analyzed for MTBE. The experiment was repeated. Measurable levels of MTBE were not detected in either of the bags filled with zero air.

Injection repeatability of MTBE was determined at three nominal concentration levels, 2 ppmC, 90 ppmC, and 180 ppmC. To prepare the three MTBE samples, known amounts of MTBE were injected into three separate Tedlar bags containing 2 ft^3 of zero air each. Results of the injection repeatability tests are given in Table 11. Relative standard deviations (C.V.) for the three MTBE concentrations were less than 4 percent.

TABLE 11. INJECTION REPEATABILITY OF MTBE

Injection	MTBE Peak Areas		
	2 ppmC	90 ppmC	180 ppmC
1	766	27,706	45,962
2	774	29,094	43,167
3	800	28,151	43,785
4	785	27,312	42,413
5	779	29,030	41,693
6	749	a	a
Avg.	776	28,259	43,404
S.D.	17	792	1,632
C.V. %	2.2	2.8	3.8

[a] Sample not taken.

The stability of MTBE in a Tedlar bag of exhaust (cold-start 505) was determined. A 1990 Chevrolet Lumina was operated over a UDDS cycle using the baseline aromatic-enriched fuel (no MTBE) to generate the bag of exhaust. A gas mixture of MTBE in air was injected into the bag of exhaust to give a nominal 2 ppmC concentration of MTBE. The bag was analyzed four times in a 24-hour period. A variation of four percent was calculated. This value is within the repeatability of the method. The results of the stability experiment are given in Table 12.

TABLE 12. STABILITY OF 2 PPMC MTBE IN A TEDLAR BAG OF EXHAUST FROM A COLD-START 505

Elapsed Time, hours	MTBE Peak Area
0	838
2.9	902
6.0	898
23.8	931
Avg.	892
S.D.	39
C.V. %	4

Linear response of the FID for MTBE was demonstrated by diluting a gas standard containing MTBE and ETBE. The gas standard was prepared by Scott Specialty Gases to an analytical accuracy of ±1 percent. The gas was diluted with air to give 20, 40, 60, and 80 percent concentrations of the standard gas. A gas divider was used for the dilutions. MTBE produced a linear curve ($r^2 = 1.00$) between 5 and 25 ppmC MTBE. MTBE peak concentrations and areas are provided in Table 13.

TABLE 13. MTBE LINEARITY DETERMINATION CURVE, 5 TO 25 PPMC

Concentration MTBE, ppmC	Peak Area
5.0	1911
10.0	3957
14.9	6001
19.9	8120
24.9	9716
r^2	1.00
y-intercept	-2.27
slope	398

A low range curve (1.5 to 10.5 ppmC MTBE) was also generated to determine if the GC response is linear at the lower concentration range. Standards containing MTBE concentrations from 1.5 to 10.5 ppmC were prepared and analyzed to determine the linearity of the C_5 to C_{10} hydrocarbon speciation GC to MTBE. The system was found to give a linear response ($r^2 = 0.99$) over this concentration range. The results of the curve generation are given in Table 14.

Please note that different FID amplifier attenuations were used to generate the curves described in Tables 13 and 14. The curve slopes and the areas for equivalent MTBE concentrations will therefore be different.

TABLE 14. MTBE LINEARITY DETERMINATION CURVE, 1.5 TO 10.5 PPMC

Concentration MTBE, ppmC	Peak Area
1.5	311
4.5	894
6.0	1215
8.0	1511
10.5	1875
r^2	0.99
y-intercept	98
slope	174

IV. VEHICLE TESTING

Vehicle testing commenced with the first test vehicle on January 31, 1990, and was completed on June 19, 1990, with the fifth vehicle. The Test Schedule for the program is given in Table 15. Test numbers are also provided in the Table for each vehicle-fuel combination for identification of individual test results in Appendices B and C. The vehicle number appears in the first digit position of the test number, the fuel number is located in the second digit position, and the third digit position represents the test sequence.

Before unregulated emissions testing was initiated, each vehicle was operated over a 3-bag FTP for regulated emissions only. The emission results from these initial tests were reported to the EPA Project Officer. Upon approval of the Project Officer, testing with the test fuels was begun. The vehicles were not tuned-up prior to the performance of any emission tests.

The vehicles were operated over additional prep cycles between fuel changes to condition the charcoal canister. The purpose of canister conditioning is to minimize carry-over effects from one fuel to the next. In discussions with the EPA Project Officer, it was decided to use an extended "prep" cycle. The vehicle was operated over a "triple-prep," i.e., three UDDS cycles with a minimum one-hour soak between cycles. This vehicle preconditioning procedure is described in Part 86 Subpart B of the Code of Federal Regulations.

TABLE 15. TEST SEQUENCE AND TEST NUMBERING

Fuel	Sequence and Number of FTP Tests	Vehicle 1 1990 Chevrolet Lumina	Vehicle 2 1977 Mercury Marquis	Vehicle 3 1983 Buick Regal	Vehicle 4 1974 Chevrolet Impala	Vehicle 5 1990 Ford Probe
Baseline Fuel - Aromatic-enriched (EM-905-F)	2	111, 112	211, 212	311, 312	411, 412	511, 512
10% Ethanol Blend (EM-906-F)	3	121, 122, 123	221, 222, 223	321, 322, 323	421, 422, 423	521, 522, 523
Baseline Fuel	1	113	213	313	413	513
16.4% MTBE Blend (EM-907-F)	3	131, 132, 133	231, 232, 233	331, 332, 333	431, 432, 433	531, 532, 533
Baseline Fuel	1	114	214	314	414	514
19.1% ETBE Blend (EM-908-F)	3	141, 142, 143	241, 242, 243	341, 342, 343	441, 442, 443	541, 542, 543
Baseline Fuel	2	115, 116	215, 216	315, 316	415, 416	515, 516

V. RESULTS

Regulated and unregulated emission results and fuel economy values are reported in this section. Regulated exhaust emissions include total hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NO_x). In addition, HC was measured in evaporative emissions tests. Several currently unregulated emissions were also measured in both exhaust and evaporative emissions tests. Exhaust was evaluated for ethylene, 1,3-butadiene, isobutylene, benzene, toluene, xylenes, formaldehyde, acetaldehyde, ethanol, methyl tertiary butyl ether (MTBE), and nitrous oxide (N_2O). MTBE, benzene, and ethanol were measured in evaporative emissions tests. The test fuels used do not allow separation of the effects of individual fuel parameters such as distillation, density, aromatics, or oxygen content. The fuels were chosen to provide insight into the potential overall effects of these oxygenates on toxic and unregulated emissions.

A. Initial Check-Out FTP Tests

Each vehicle was operated over a 3-bag FTP for the measurement of regulated emissions prior to acceptance into the program as a test vehicle. With the EPA Project Officer's approval, based on emissions being in a range typical of in-use vehicles, testing was initiated with the vehicles according to the previously specified Test Plan. Results from these initial tests are summarized in Table 16 and computer printouts are given in Appendix A. An unleaded emissions test fuel, Howell EEE, was used in these initial tests.

TABLE 16. EMISSIONS RESULTS AND FUEL ECONOMIES FROM INITIAL CHECK-OUT TESTS ON THE TEST VEHICLES

Vehicle	Exhaust Emissions, g/mi			Fuel Economy, mi/gal
	HC	CO	NO_x	
1974 Chevrolet Impala	10.23	152	2.52	10.85
1977 Mercury Marquis	1.26	0.87	1.85	12.97
1983 Buick Regal	0.91	9.24	2.01	17.66
1990 Chevrolet Lumina	0.17	2.43	0.21	23.22
1990 Ford Probe	0.23	3.41	1.14	19.78

B. Regulated Emission Results and Fuel Economy

Regulated exhaust and evaporative emissions and fuel economy results from the five test vehicles operated with the four test fuels are summarized in Table 17. Graphical representations of the data are presented in Figures 6 through 15. Results from individual tests are given in Appendix B and computer printouts are provided in Appendix C. Note that the total hydrocarbon (HC) exhaust emissions include a correction for the oxygen content of the fuel (no such correction was attempted for the total hydrocarbon evaporative emissions); however, no correction was made for the FID response factor of the oxygenated components in either exhaust or evaporative hydrocarbon emissions. Regulated emissions and fuel economy values from tests conducted with the blend fuels have been compared to emissions and fuel economy values measured from tests performed with the baseline aromatic-enriched fuel.

TABLE 17. SUMMARY OF REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY

Vehicle	Fuel	Exhaust Emissions, g/mi			Fuel Economy, mi/gal	Evaporative Emissions, g HC		
		HC	CO	NO_x		Diurnal	Hot Soak	Total
Chevrolet Impala	Baseline (EM-905-F)	8.04	144	2.86	11.2	3.33	2.62	5.95
	10% Ethanol (EM-906-F)	7.86	138	2.82	10.8	2.44	3.61	6.06
	16.4% MTBE (EM-907-F)	5.97	113	2.94	11.1	2.40	3.77	6.17
	19.1% ETBE (EM-908-F)	5.96	116	2.88	11.0	3.13	3.31	6.44
Mercury Marquis	Baseline (EM-905-F)	0.90	2.47	1.67	12.9	5.3	14.0	19.3
	10% Ethanol (EM-906-F)	1.07	1.14	1.81	12.7	5.8	20.7	26.5
	16.4% MTBE (EM-907-F)	1.10	0.63	1.71	12.6	3.6	15.8	19.3
	19.1% ETBE (EM-908-F)	1.15	0.77	1.58	12.4	3.2	13.7	16.9
Buick Regal	Baseline (EM-905-F)	0.76	7.12	1.88	19.6	0.91	1.25	2.16
	10% Ethanol (EM-906-F)	0.78	5.94	1.88	19.0	1.29	1.55	2.84
	16.4% MTBE (EM-907-F)	0.68	5.67	1.93	18.8	0.91	1.20	2.12
	19.1% ETBE (EM-908-F)	0.76	5.80	1.94	18.7	0.87	1.17	2.04

TABLE 17 (CONT'D). SUMMARY OF REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY

Vehicle	Fuel	Exhaust Emissions, g/mi			Fuel Economy, mi/gal	Evaporative Emissions, g HC		
		HC	CO	NO_x		Diurnal	Hot Soak	Total
Chevrolet Lumina	Baseline (EM-905-F)	0.19	2.57	0.26	24.0	0.18	0.26	0.44
	10% Ethanol (EM-906-F)	0.14	1.95	0.26	23.1	0.38	0.29	0.67
	16.4% MTBE (EM-907-F)	0.16	1.93	0.26	23.5	0.22	0.30	0.52
	19.1% ETBE (EM-908-F)	0.19	2.22	0.24	22.8	0.23	0.33	0.56
Ford Probe	Baseline (EM-905-F)	0.27	4.27	1.11	19.2	0.15	0.20	0.34
	10% Ethanol (EM-906-F)	0.20	2.94	1.38	18.3	0.12	0.30	0.42
	16.4% MTBE (EM-907-F)	0.24	3.51	1.26	18.6[a]	0.12	0.22	0.34
	19.1% ETBE (EM-908-F)	0.29	4.18	1.07	18.6[a]	0.12	0.19	0.31

[a] Although average fuel economies are the same, the greater spread of the MTBE values resulted in overlap with the baseline fuel economy while the tighter spread of the ETBE values resulted in a lower average fuel economy compared to the baseline fuel.

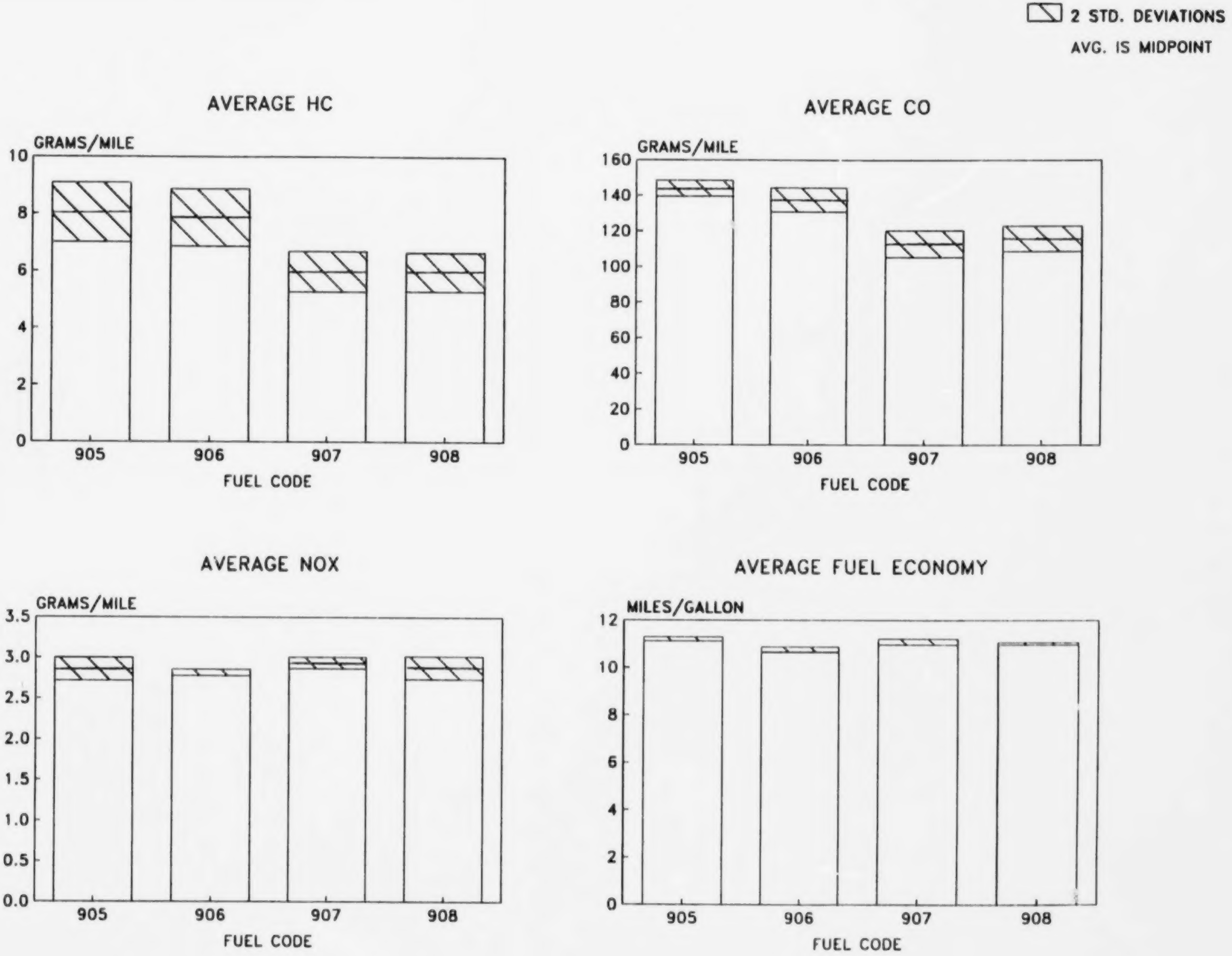


FIGURE 6. FUEL BY FUEL COMPARISON OF REGULATED EXHAUST EMISSIONS AND FUEL ECONOMY FOR VEHICLE 4, A 1974 CHEVROLET IMPALA

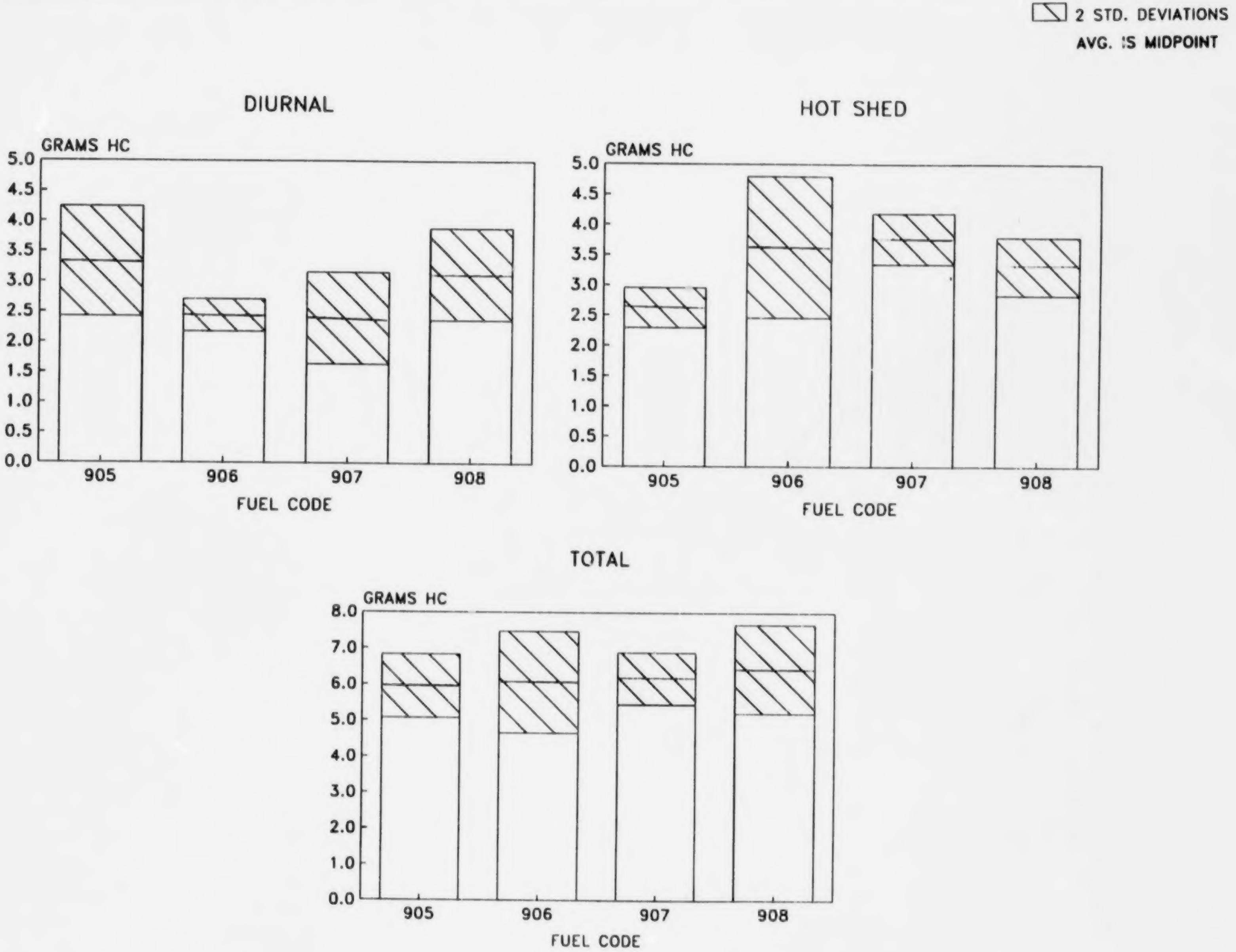


FIGURE 7. FUEL BY FUEL COMPARISON OF TOTAL HYDROCARBON EVAPORATIVE EMISSIONS FOR VEHICLE 4, A 1974 CHEVROLET IMPALA

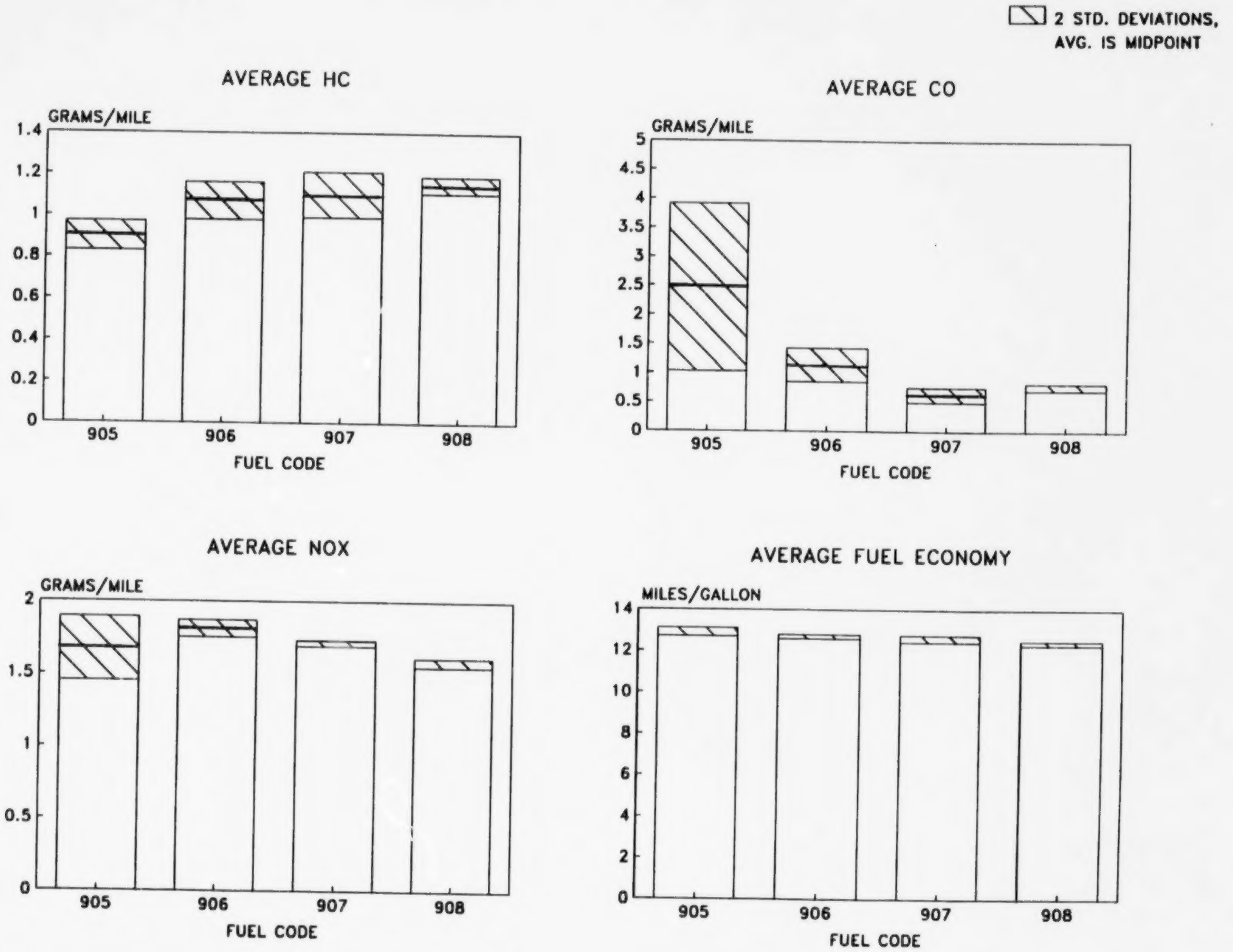


FIGURE 8. FUEL BY FUEL COMPARISON OF REGULATED EXHAUST EMISSIONS AND FUEL ECONOMY FOR VEHICLE 2, A 1977 MERCURY MARQUIS

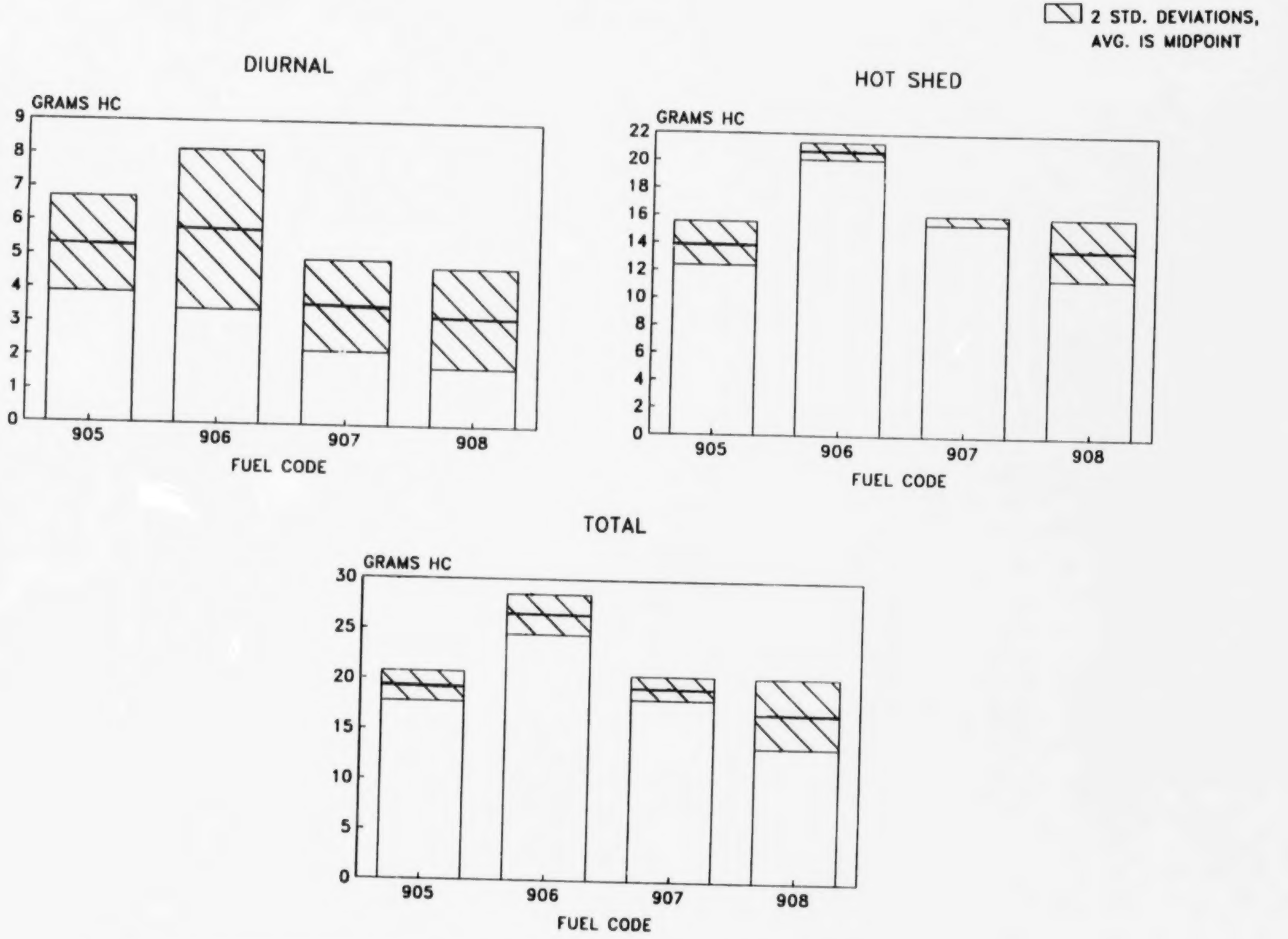


FIGURE 9. FUEL BY FUEL COMPARISON OF TOTAL HYDROCARBON EVAPORATIVE EMISSIONS FOR VEHICLE 2, A 1977 MERCURY MARQUIS

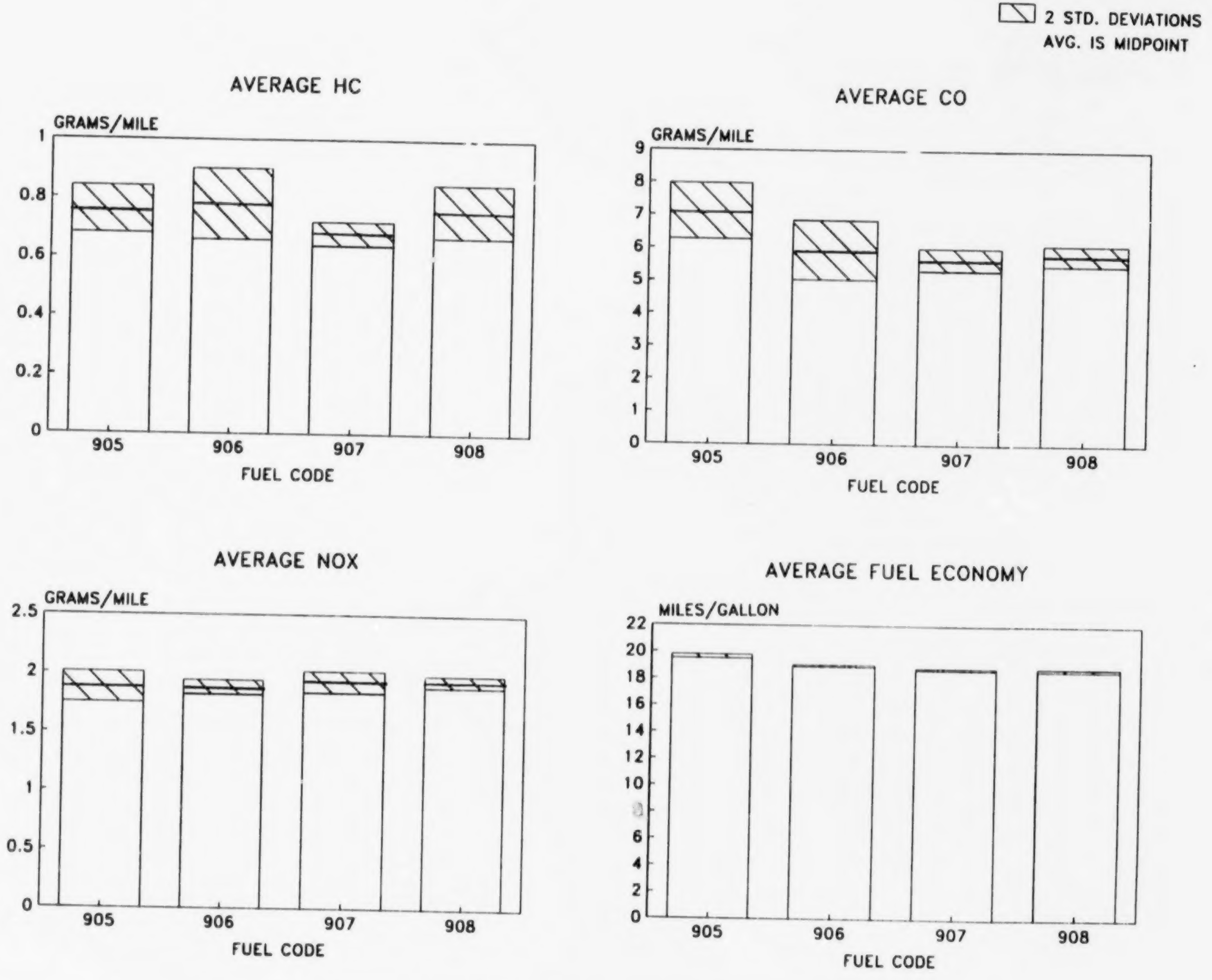


FIGURE 10. FUEL BY FUEL COMPARISON OF REGULATED EXHAUST EMISSIONS AND FUEL ECONOMY FOR VEHICLE 3, A 1983 BUICK REGAL

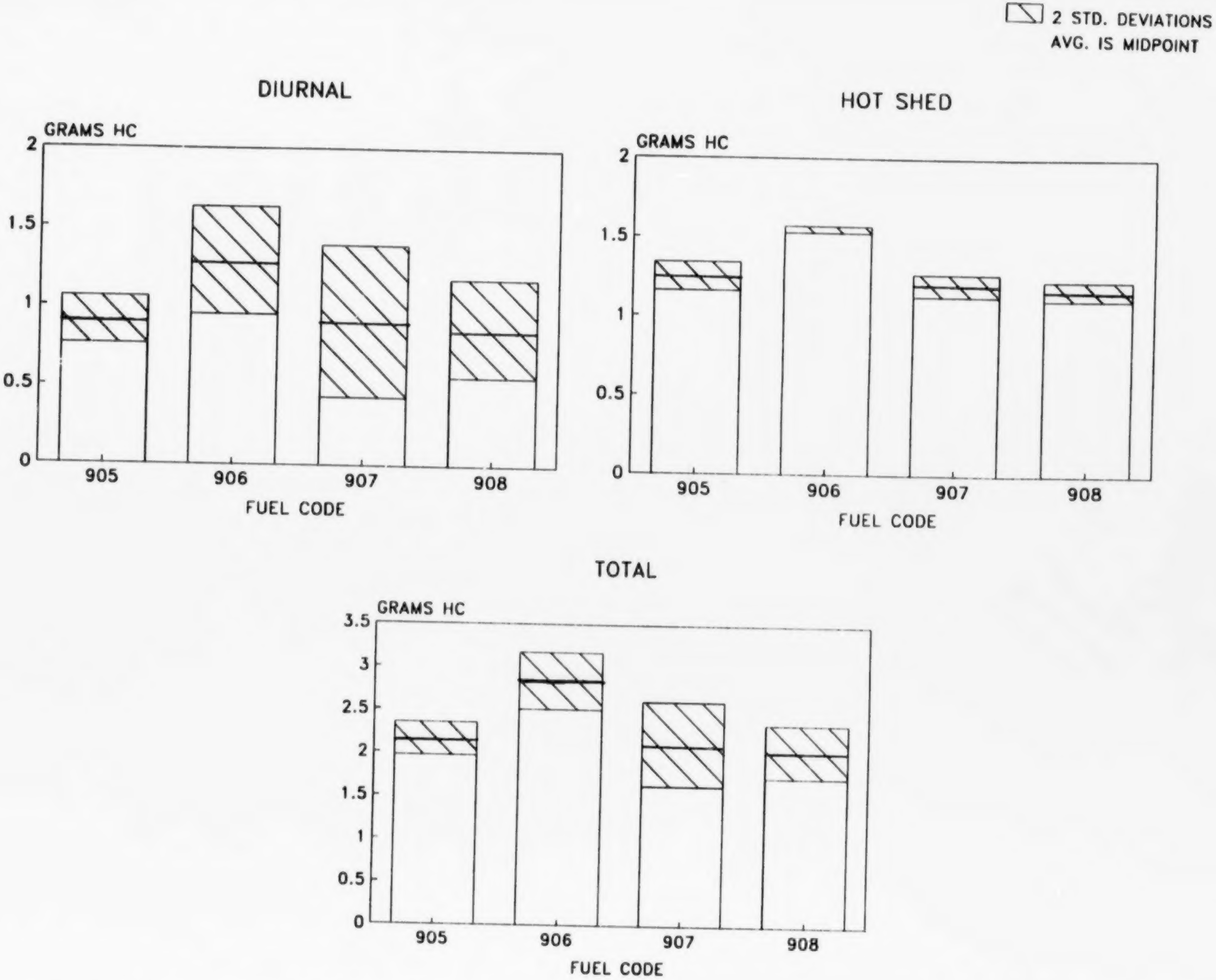
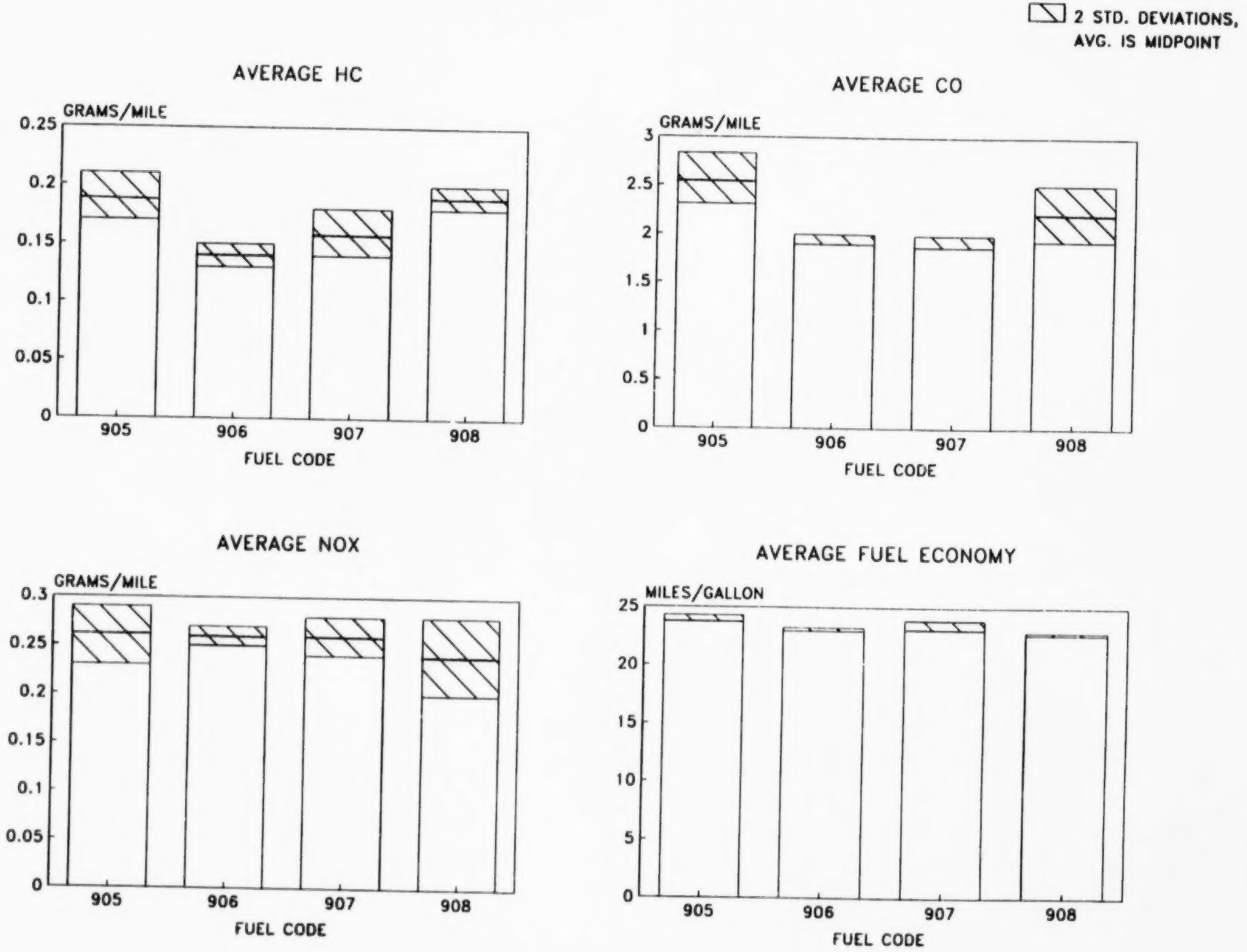


FIGURE 11. FUEL BY FUEL COMPARISON OF TOTAL HYDROCARBON EVAPORATIVE EMISSIONS FOR VEHICLE 3, A 1983 BUICK REGAL


AVERAGE HC

AVERAGE CO

AVERAGE NOX

AVERAGE FUEL ECONOMY

FIGURE 12. FUEL BY FUEL COMPARISON OF REGULATED EXHAUST EMISSIONS AND FUEL ECONOMY FOR VEHICLE 1, A 1990 CHEVROLET LUMINA

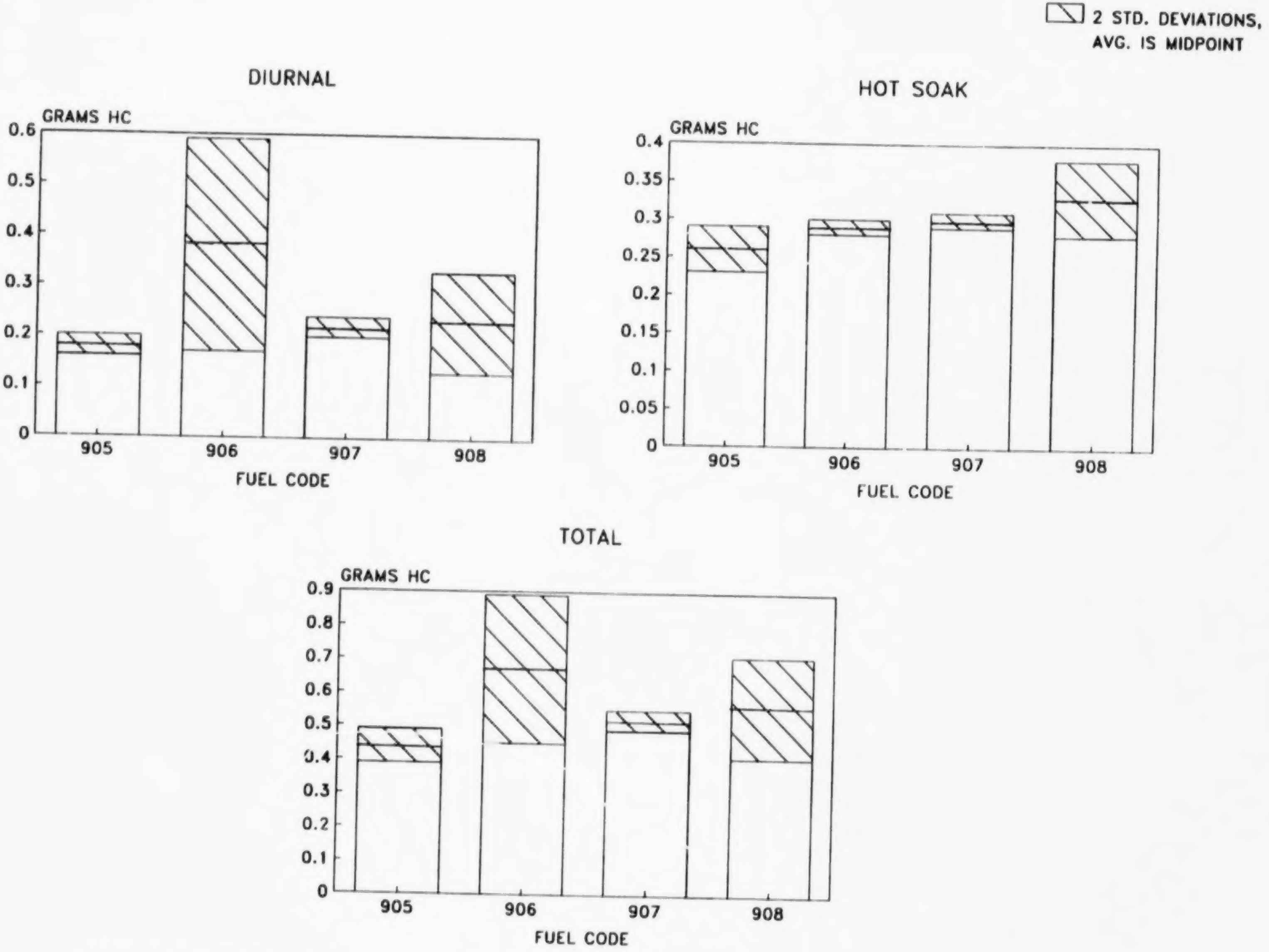


FIGURE 13. FUEL BY FUEL COMPARISON OF TOTAL HYDROCARBON EVAPORATIVE EMISSIONS FOR VEHICLE 1, A 1990 CHEVROLET LUMINA

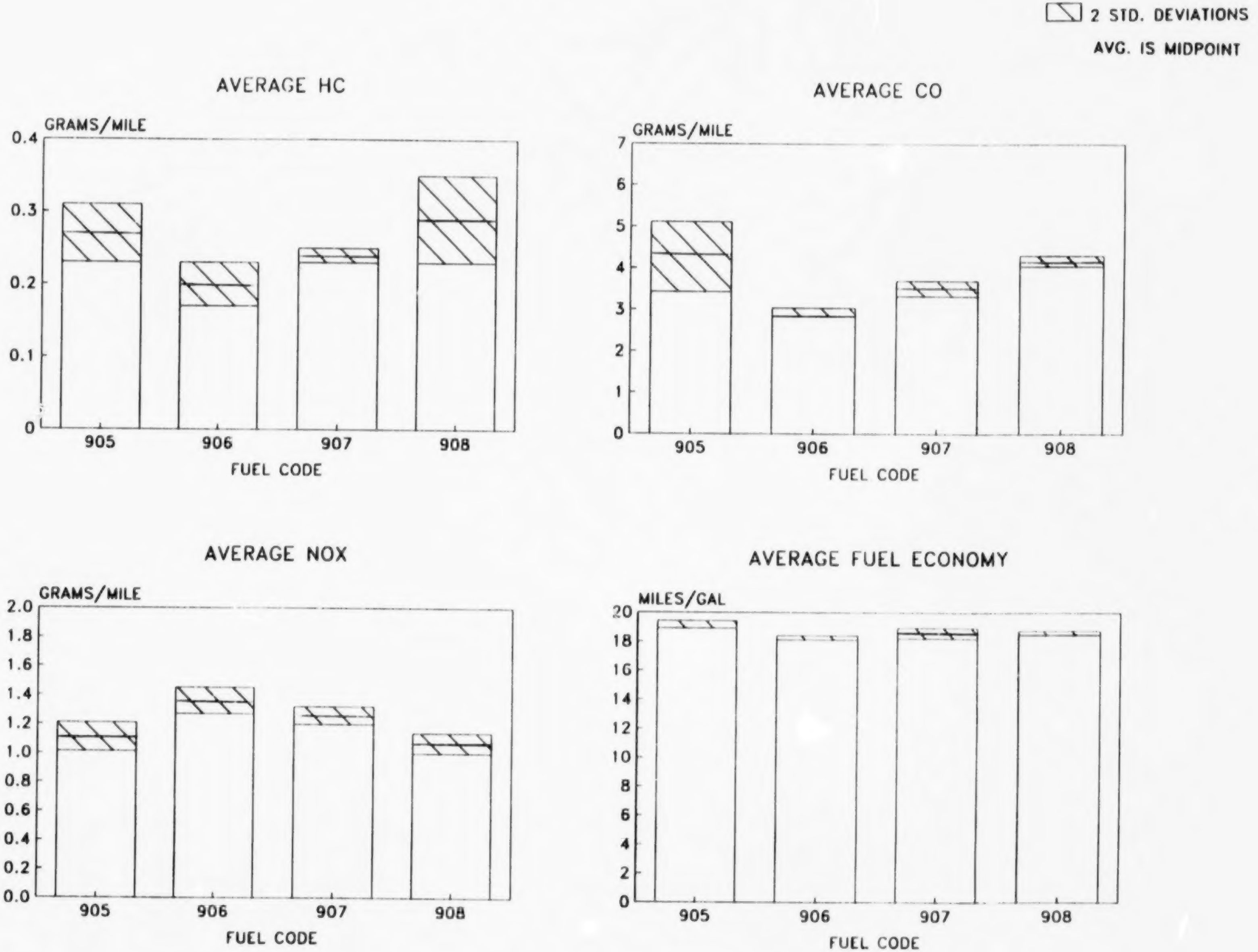
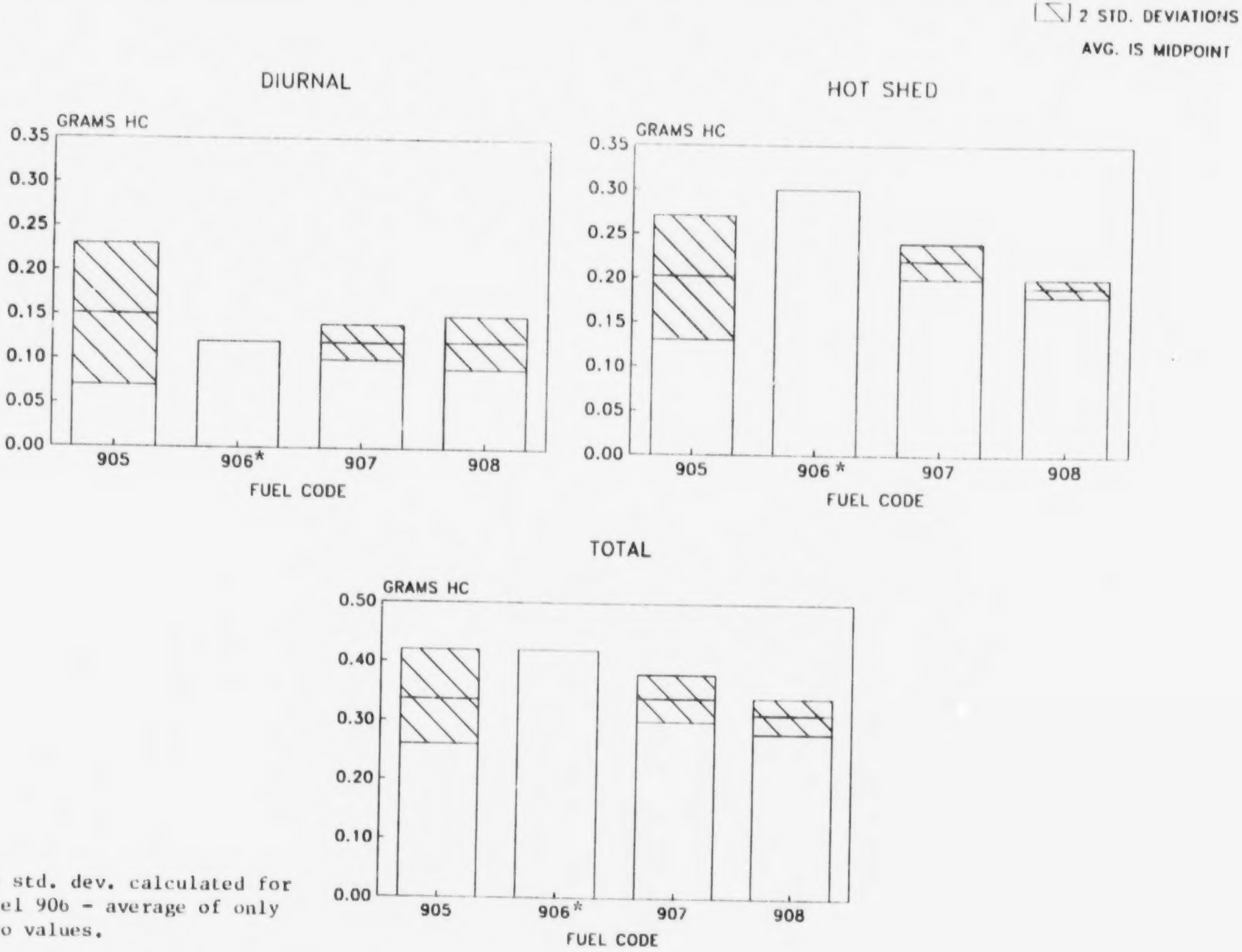


FIGURE 14. FUEL BY FUEL COMPARISON OF REGULATED EXHAUST EMISSIONS AND FUEL ECONOMY FOR VEHICLE 5, A 1990 FORD PROBE



*No std. dev. calculated for Fuel 906 - average of only two values.

FIGURE 15. FUEL BY FUEL COMPARISON OF TOTAL HYDROCARBON EVAPORATIVE EMISSIONS FOR VEHICLE 5, A 1990 FORD PROBE

In general, CO exhaust emissions and fuel economy were found to be lower during operation with the oxygenated blends relative to the baseline aromatic-enriched fuel. HC, NO_X, and evaporative total HC emissions were not affected as consistently.

The Probe exhibited considerable variability in exhaust HC and CO emissions throughout the testing sequence. Hydrocarbons steadily increased from 0.22 to 0.33 g/mile with the baseline fuel. Carbon monoxide also increased from 2.98 to 4.86 g/mile. These emission trends could not be traced to any change in the testing procedure or to the driveability of the vehicle.

Emissions of NO_X did not increase or decrease significantly for any of the vehicle-fuel combinations except for the 1990 Probe operated with the ethanol blend which had NO_X emissions of 1.34 g/mile versus 1.11 g/mile on the baseline fuel.

C. Unregulated Emissions Results

Several unregulated species were evaluated in exhaust and evaporative emissions for this program. The compounds are listed below.

Exhaust Emission:

- Ethylene
- 1,3-Butadiene
- Isobutylene
- Benzene
- Toluene
- m-, p-Xylenes
- o-Xylene
- Formaldehyde
- Acetaldehyde
- Total Aldehydes and Ketones
- Ethanol
- MTBE
- Nitrous Oxide (N_2O)

Evaporative Emission:

- MTBE
- Benzene
- Ethanol

The interest in these particular compounds is generated in part by their contribution to smog by photochemical reactions with sunlight and oxides of nitrogen following their emission from automobiles. In addition, several of these compounds, namely benzene, 1,3-butadiene, formaldehyde, and acetaldehyde, are known or suspected carcinogens. Nitrous oxide is an important greenhouse gas. The primary source of ethylene, 1,3-butadiene, isobutylene, formaldehyde, acetaldehyde, and N_2O is the combustion of gasoline and blend fuels. Several of the species are found in one or more of the fuels, including benzene, toluene, xylenes, ethanol, and MTBE; so they can be emitted as a result of noncombusted residual air-fuel mixture. The presence of benzene and ethanol in exhaust is likely due to two sources, noncombustion products (from the fuel) and/or combustion or partial combustion products. Benzene can be produced in the exhaust by the dealkylation of toluene and xylenes, and ethanol can possibly be formed as a fragmentation product of ETBE.

The results from unregulated emissions tests are given by vehicle in Appendix D for each test. These emissions values, along with standard deviations, and confidence levels, are summarized in Tables 18 through 22 for the five test vehicles. Confidence levels were determined by the Wilcoxon Rank Sum Test and were used for evaluating unregulated emissions from the oxygenated fuel blends relative to the baseline fuel. Some of the confidence levels were calculated using emissions data that had been normalized to reduce emissions drift over time. A discussion of this data normalization and evaluation is provided in the following section. Minimum detection values are given in Table 23.

TABLE 18. COMPARISON OF AVERAGE FTP UNREGULATED EVAPORATIVE AND EXHAUST EMISSIONS FROM A 1974 CHEVROLET IMPALA

	Exhaust Emissions, mg/mi										
	Baseline Fuel (EM-905-F)		10% Ethanol (EM-906-F)			16.4% MTBE (EM-907-F)			19.1% ETBE (EM-908-F)		
Emission	Average Emission	Std. Dev.	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]
Speciated Hydrocarbons											
Ethylene	712	58	801	69	90.4	612	80	90.4	666	58	28.6
1,3-Butadiene	60.4	8.0	68.0	6.3	73.8	58.2	5.2	45.2	61.5	8.2	99.6
Isobutylene	133	9	150	13	83.4	240	19	97.6	250	17	97.6
Benzene	421	28	332	27	96.4	240	28	96.4	234	22	96.4
Toluene	986	80	489	28	96.4	346	46	96.4	317	30	96.4
m-, p-Xylenes	453	61	245	19	97.6	174	13	97.6	165	16	97.6
o-Xylene	205	28	96.2	7.5	97.6	64.6	2.9	97.6	62.8	4.0	97.6
Oxygenated Hydrocarbons and N_2O											
Formaldehyde	84.1	8.4	80.3	20.9	0	100	9.1	95.2	88.6	3.9	73.8
Acetaldehyde[b]	19.5	0.9	26.6	5.8	97.6	21.6	2.0	83.4	47.9	1.7	97.6
Total Aldehydes & Ketones	152	18	144	37	0	171	18	73.8	185	7	95.2
Ethanol	ND[c]	--	44.8	2.6	97.6	Trace[d]	--	73.8	67.8	22.8	97.6
MTBE	1.0	1.5	ND	--	73.8	133	10	97.6	ND	--	73.8
N_2O	16.0	7.9	16.0	14.2	0	14.8	2.2	0	10.4	9.7	9.6
	Evaporative Emissions, mg/test										
Evaporative Emissions											
MTBE	4	9	ND	--	9.6	777	62	97.6	ND	--	9.6
Benzene	79	12.2	73	12	9.6	72	8	28.6	77	22	28.6
Ethanol	11	27	280	94	97.6	24	6	45.2	4	7	73.8

[a] Confidence level of a significant difference from baseline, determined by the Wilcoxon Rank Sum Test.
[b] Normalized emissions values.
[c] ND - Not detected. Less than the detection limit.
[d] Trace - Detected but not quantifiable above the detection limit.

TABLE 19. COMPARISON OF AVERAGE FTP UNREGULATED EVAPORATIVE AND EXHAUST EMISSIONS FROM A 1977 MERCURY MARQUIS

Emission	Exhaust Emissions, mg/mi										
	Baseline Fuel (EM-905-F)		10% Ethanol (EM-906-F)			16.4% MTBE (EM-907-F)			19.1% ETBE (EM-908-F)		
	Average Emission	Std. Dev.	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]
Speciated Hydrocarbons											
Ethylene	52.8	2.5	58.2	1.7	96.6	58.9	5.8	88.4	69.6	0.3	98.4
1,3-Butadiene[b]	1.5	0.1	1.7	0.5	45.2	1.7	0.2	90.4	2.2	0.2	97.6
Isobutylene	8.1	0.8	8.8	0.8	62.0	33.6	4.5	97.6	29.1	7.0	97.6
Benzene	17.3	2.3	13.2	3.1	88.4	12.6	0.8	98.4	14.7	3.9	48.4
Toluene	51.3	8.7	23.8	3.9	98.4	22.4	1.5	98.4	22.5	5.1	98.4
m-, p-Xylenes	24.5	3.4	14.4	1.3	98.4	11.2	0.5	98.4	14.0	1.6	98.4
o-Xylene	11.9	1.8	8.1	1.2	96.6	5.8	0.3	98.4	7.3	1.4	98.4
Oxygenated Hydrocarbons and N_2O											
Formaldehyde	31.7	6.6	44.4	2.3	97.6	64.1	8.9	97.6	55.2	2.5	97.6
Acetaldehyde	10.9	1.8	22.4	0.6	97.6	14.3	2.0	95.2	35.2	3.3	97.6
Total Aldehydes & Ketones	56.4	11.8	84.2	7.2	97.6	84.1	24.4	97.6	116.9	9.8	97.6
Ethanol	ND[c]	--	3	1	98.4	ND	--	0	ND	--	0
MTBE	1.5	3.9	ND	--	16.6	24.5	7.9	98.4	ND	--	16.6
N_2O	10.0	2.2	11.2	3.6	28.6	13.4	0.6	90.4	11.0	1.9	45.2
	Evaporative Emissions, mg/test										
Evaporative Emissions											
MTBE	68	167	ND	--	9.6	1991	546	97.6	ND	--	9.6
Benzene[b]	118	9	251	37	97.6	157	26	97.6	148	7.6	97.6
Ethanol	115	229	1500	600	97.6	215	150	83.4	ND	3.3	73.8

[a] Confidence level of a significant difference from baseline, determined by the Wilcoxon Rank Sum Test.

[b] Normalized emissions values.

[c] ND - Not detected. Less than the detection limit.

TABLE 20. COMPARISON OF AVERAGE FTP UNREGULATED EVAPORATIVE AND EXHAUST EMISSIONS FROM A 1983 BUICK REGAL

Emission	Exhaust Emissions, mg/mi										
	Baseline Fuel (EM-905-F)		10% Ethanol (EM-906-F)			16.4% MTBE (EM-907-F)			19.1% ETBE (EM-908-F)		
	Average Emission	Std. Dev.	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]
Speciated Hydrocarbons											
Ethylene	37.7	3.2	37.2	6.1	45.2	34.2	2.6	83.4	38.5	1.1	73.8
1,3-Butadiene	1.3	0.2	1.1	0.4	62.0	0.8	0.2	97.6	1.1	0.1	83.4
Isobutylene	6.0	0.5	5.8	0.5	62.0	16.2	1.1	97.6	17.2	0.5	97.6
Benzene	26.6	3.7	21.2	3.9	90.4	18.2	1.8	97.6	17.5	1.6	97.6
Toluene	77.8	10.7	32.1	5.8	97.6	23.5	3.0	97.6	25.7	6.8	97.6
m-, p-Xylenes	33.9	5.0	17.5	3.4	97.6	10.9	1.4	97.6	12.6	2.1	97.6
o-Xylene	15.6	2.0	7.7	1.4	97.6	5.4	0.6	97.6	5.5	0.9	97.6
Oxygenated Hydrocarbons and N_2O											
Formaldehyde	5.6	1.3	5.9	0.8	28.6	5.2	1.4	28.6	5.3	2.7	0
Acetaldehyde	2.3	0.6	7.0	0.6	97.6	2.1	0.4	28.6	5.1	1.2	97.6
Total Aldehydes & Ketones	9.9	1.1	16.1	2.4	97.6	8.8	2.7	45.2	13.7	3.5	90.4
Ethanol	ND[b]	--	18.1	15.8	92.8	ND	--	0	ND	--	0
MTBE	Trace[c]	--	ND	--	73.8	20.7	1.8	97.6	Trace	--	9.6
N_2O	231	20	233	19	0	239	2	45.2	223	0.6	62.0
	Evaporative Emissions, mg/test										
Evaporative Emissions											
MTBE	8	16	ND	--	45.2	171	30	97.6	11	10	73.8
Benzene	50	6	59	7	73.8	44	4	73.8	37	4	97.6
Ethanol	10	15	300	76	97.6	13	13	9.6	4	7	28.6

[a] Confidence level of a significant difference from baseline, determined by the Wilcoxon Rank Sum Test.

[b] ND - Not detected. Less than the detection limit.

[c] Trace - Detected but not quantifiable above the detection limit.

TABLE 21. COMPARISON OF AVERAGE FTP UNREGULATED EVAPORATIVE AND EXHAUST EMISSIONS FROM A 1990 CHEVROLET LUMINA

	Exhaust Emissions, mg/mi										
	Baseline Fuel (EM-905-F)		10% Ethanol (EM-906-F)			16.4% MTBE (EM-907-F)			19.1% ETBE (EM-908-F)		
Emission	Average Emission	Std. Dev.	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]
Speciated Hydrocarbons											
Ethylene	13.7	0.84	13.2	0.9	73.8	12.7	0.9	90.4	14.5	0.1	90.4
1,3-Butadiene	0.8	0.04	0.8	0.1	9.6	0.8	0.1	9.6	1.0	0.1	97.6
Isobutylene	3.3	0.27	2.9	0.4	83.4	7.2	0.6	97.6	8.1	0.3	97.6
Benzene	10.7	1.1	6.1	0.8	97.6	5.9	0.4	97.6	8.2	0.2	97.6
Toluene	23.5	1.7	9.2	2.8	97.6	8.5	2.1	97.6	10.8	0.8	97.6
m-, p-Xylenes	8.9	1.7	3.4	0.7	97.6	3.7	0.6	97.6	5.2	0.6	97.6
o-Xylene	4.0	0.8	1.1	1.0	97.6	1.7	0.2	97.6	2.5	0.1	97.6
Oxygenated Hydrocarbons and N_2O											
Formaldehyde	3.1	0.55	4.1	0.5	97.6	4.3	0.3	97.6	4.3	0.6	97.6
Acetaldehyde	1.4	0.62	2.6	1.2	83.4	1.2	0.2	9.6	2.6	0.1	90.4
Total Aldehydes & Ketones	6.1	0.84	8.7	1.6	95.2	7.5	0.4	95.2	9.1	0.3	97.6
Ethanol	ND[b]	--	ND	--	0	ND	--	0	ND	--	0
MTBE	ND	--	ND	--	0	4.1	4.0	97.6	ND	--	0
N_2O	42.4	13.9	38.0	8.5	9.6	45	8.3	28.6	36.4	12.1	62.0
	Evaporative Emissions, mg/test										
Evaporative Emissions											
MTBE	ND	--	ND	--	0	37	9.6	97.6	ND	--	0
Benzene	11	3.0	15	2.1	90.4	11	7.5	9.6	13	2.0	73.8
Ethanol	5	12	40	20	95.2	ND	--	9.6	ND	--	9.6

[a] Confidence level of a significant difference from baseline, determined by the Wilcoxon Rank Sum Test.

[b] ND - Not detected. Less than the detection limit.

TABLE 22. COMPARISON OF AVERAGE FTP UNREGULATED EVAPORATIVE AND EXHAUST EMISSIONS FROM A 1990 FORD PROBE

Emission	Exhaust Emissions, mg/mi										
	Baseline Fuel (EM-905-F)		10% Ethanol (EM-906-F)			16.4% MTBE (EM-907-F)			19.1% ETBE (EM-908-F)		
	Average Emission	Std. Dev.	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]	Average Emission	Std. Dev.	Confidence Level, %[a]
Speciated Hydrocarbons											
Ethylene[b]	12.3	0.6	11.5	0.2	90.4	10.9	1.1	95.2	10.7	0.6	97.6
1,3-Butadiene[b]	0.8	0.2	0.8	0.1	28.6	0.7	0.2	73.8	0.7	0.1	73.8
Isobutylene[b]	3.5	0.0	3.3	0.5	45.2	8.7	0.4	97.6	9.6	0.7	97.6
Benzene	14.0	1.7	8.0	1.3	97.6	8.5	0.6	97.6	9.5	1.3	97.6
Toluene	37.2	5.4	14.1	2.2	97.6	13.6	1.0	97.6	16.6	3.6	97.6
m-, p-Xylenes	21.8	3.7	8.5	1.5	97.6	9.1	1.5	97.6	9.9	2.0	97.6
o-Xylene[b]	9.1	0.5	4.5	0.4	96.4	3.4	0.7	96.4	3.1	0.5	96.4
Oxygenated Hydrocarbons and N_2O											
Formaldehyde	3.3	1.1	3.8	0.9	45.2	1.8	0.1	83.4	3.4	0.1	0
Acetaldehyde	0.8	0.3	2.2	0.4	97.6	0.3	0.1	95.2	1.8	0.4	97.6
Total Aldehydes & Ketones	4.5	1.5	6.4	1.4	73.8	2.9	0.4	83.4	5.7	0.7	45.2
Ethanol	ND[c]	--	8.5	0.8	97.6	ND	--	9.6	Trace[d]	--	90.4
MTBE	ND	--	ND	--	9.6	6.4	1.1	97.6	ND	--	9.6
N_2O	74.3	10.6	66.5	7.4	62.0	83.5	4.4	83.4	73.1	12.2	28.6
	Evaporative Emissions, mg/test										
Evaporative Emissions											
MTBE	ND	--	ND	--	9.6	7	8	95.2	ND	--	9.6
Benzene	16	7	18	--	0	10	3	60.8	16	7	0
Ethanol	12	16	112	--	92.8	14	1	45.2	Trace	--	9.6

[a] Confidence level of a significant difference from baseline, determined by the Wilcoxon Rank Sum Test.

[b] Normalized emissions values.

[c] ND - Not detected. Less than the detection limit.

[d] Trace - Detected but not quantifiable above the detection limit.

TABLE 23. MINIMUM DETECTION VALUES (MDV) FOR UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Emission	UDDS, mg/mi	FTP Evaporative Test, mg
Ethylene, Benzene, Toluene	1.0	3
1,3-Butadiene, Isobutylene	0.5	--[a]
MTBE	2.0	6
m-, p-Xylenes, o-Xylene	1.5	--[a]
Formaldehyde	0.03	--[a]
Acetaldehyde	0.04	--[a]
Ethanol	3.0	10
N_2O	5.0	--[a]

[a] Not measured in this program

VI. STATISTICAL EVALUATION
(Unregulated Emissions Only)

The goal of this research program was to provide a preliminary assessment of the effect of three oxygenated fuel blends on selected unregulated emissions. To achieve this goal, each of five test vehicles was operated according to the test sequence shown in Table 15. For each vehicle, six FTP tests were conducted with the baseline aromatic-enriched fuel and three tests each were performed with the three oxygenated fuel blends. (For two of the vehicles, additional tests were performed to confirm the initial measurements. These tests are discussed in the Quality Assurance Section.) Unregulated emissions were measured in both exhaust and evaporative portions of the FTP cycle.

The statistical method selected for evaluating the resulting data is the two-sample Wilcoxon Rank Sum Test. This non-parametric procedure is appropriate for the small sample sizes and skewed (non-normally distributed) data typical of emission test data as generated in this program. The emissions of each oxygenated fuel were compared with those of the baseline fuel. The *Statgraphics* version of the Wilcoxon Test (from Statistical Graphics Corporation) was used to process the emissions data and obtain the test statistics. The attained significance levels (converted into confidence levels) were calculated for each unregulated pollutant from each of the oxygenated fuel blends using tables of the Wilcoxon Rank Sum Test. These values are given in Tables 18 through 22 along with the averages and standard deviations of the emission rates. Note that small significance levels, or conversely, large confidence levels, indicate a statistically significant difference between the average emissions of the oxygenated blends and the baseline fuel.

Unregulated emissions from some of the vehicles appeared to drift upward or downward with accumulation of vehicle test time. The Probe exhibited a linear trend in emission rates across the test time for several unregulated emissions as well as for regulated HC and CO. The variability and increase of HC and CO emissions with time from the Probe was addressed previously. To determine if the unregulated emissions were affected by significant linear time trends, either increasing or decreasing, a simple linear regression equation was fit to each unregulated pollutant on each of the vehicles operated with the baseline fuel using test time as the predictor variable. Drift in the emissions values was determined to be significant if the fitted regression equation had a significant slope coefficient (i.e., a p-value less than 0.06 or, conversely, a confidence level greater than 0.94) and a coefficient of determination (r^2) greater than 70 percent. When this occurred, the corresponding emission data were normalized along the baseline fuel regression line to the approximate midpoint in the testing sequence of the 15 FTP tests. The procedure utilized for normalizing these data is described in Appendix E.

The unregulated emissions that were normalized included acetaldehyde from the Impala and 1,3-butadiene and evaporative benzene from the Marquis. In addition, ethylene, 1,3-butadiene, isobutylene, and o-xylene emissions from the Probe were normalized. These normalized values, given in Tables 18 through 22 and in Appendix E, were used with the Wilcoxon test procedure to compare the oxygenated and baseline fuels.

Significance levels that are relatively small (or, conversely, large confidence levels) indicate a greater probability that the corresponding average emission rates from the blends are significantly different from the baseline fuel average emission rates. A confidence level of 95 percent or more is often used as a guideline for determining the significance of data. The 95 percent confidence level indicates, if the sampling method could be repeated, that 5 out of 100 of the resultant sets of data, on the average, would show a significant difference when none existed between the baseline and oxygenated fuels. For example, in Table 18, average ethylene emissions of 801 mg/mile from the 1974 Impala tested with the ethanol blend are considered to be significantly larger (at a confidence limit of 95.2 percent) than the average 712 mg/mile of ethylene emitted during operation with the baseline fuel. In contrast, the 1,3-butadiene average emissions from tests with the ethanol blend (68.0 mg/mile) are not significantly larger than from tests with the baseline fuel (60.4 mg/mile), since the confidence level is only 73.8 percent for this set of data.

Individual compounds with confidence levels exceeding 95 percent are listed in Table 24. A summary of those unregulated emissions produced by three or more of the test vehicles with confidence levels above 95 percent are provided in Tables 25 through 27 for the ethanol, MTBE, and ETBE blends, respectively.

A. Emissions Effects for All Blends

As shown in Tables 25 through 27, both toluene and xylenes (m-,p-, and o- isomers) were emitted in smaller quantities for the three blend fuels compared to the baseline fuel. Tests with the blend fuels produced roughly 40 to 70 percent less toluene and xylenes than tests conducted with the baseline fuel. The primary reason for this result is that an aromatic mixture of toluene and xylenes was included in the baseline gasoline to adjust its (R+M)/2 octane to match the oxygenate blends. The baseline fuel was composed of about 36 percent aromatics, and the blends contained about 18 to 23 percent aromatics. The aromatic contents of the blends were therefore 36 to 50 percent lower than the aromatic content of the baseline fuel. However, these lower levels of aromatics present in the oxygenate blend fuels relative to the baseline fuel do not fully explain the reductions in toluene and xylenes emissions of greater than 50 percent.

Three of the test vehicles gave lower benzene emissions with all three blends; the Impala, the Lumina, and the Probe. The Impala, equipped with no catalyst, produced twenty to forty percent less benzene during operation with the three blends. The fuel injected Lumina and Probe, both 1990 vehicles, were equipped with 3-way catalysts and no air injection. These vehicles also produced from twenty to forty percent less benzene with the blends relative to the baseline fuel.

B. Normalized Emissions

As discussed previously, some of the unregulated emissions data were normalized to minimize the effect of emissions drift during the time sequence of testing. The effect on the attained significance levels was meaningful for only a few of the emissions. For these emissions, the significance levels decreased from above 5 percent (for the non-normalized data) to below 5 percent (after normalization). This change in error rate corresponds to a change in confidence level to above 95%, which indicates that there is a significant difference in emissions between baseline and oxygenated blend fuels for the affected emissions data as normalized. Acetaldehyde emissions from the Impala operated with the ethanol blend, 1,3-butadiene and evaporative benzene emissions from the Marquis tested with the ETBE blend, and ethylene emissions produced by the Probe operated with both the MTBE and the ETBE blends switched from nonsignificant to significant when utilizing the normalized emission rates. Although the normalized average emission rates changed magnitude compared to the non-normalized values, the direction of the change (i.e., either higher or lower relative to baseline fuel emissions) was the same as for the non-normalized average emissions values.

TABLE 24. SUMMARY OF RELATIVE EMISSION RATES AND CONFIDENCE LEVELS GREATER THAN 95 PERCENT FOR INDIVIDUAL UNREGULATED EMISSIONS

Compound	Vehicle	10% Ethanol (EM-906-F)		16.4% MTBE (EM-907-F)		19.1% ETBE (EM-908-F)	
		Higher/ Lower[a]	C.L.,%[b]	Higher/ Lower[a]	C.L.,%[b]	Higher/ Lower[a]	C.L.,%[b]
Ethylene	1974 Impala						
	1977 Marquis	H	96.6			H	98.4
	1983 Regal						
	1990 Lumina						
	1990 Probe			L	95.2	L	97.6
1,3-Butadiene	1974 Impala						
	1977 Marquis					H	97.6
	1983 Regal			L	97.6		
	1990 Lumina					H	97.6
	1990 Probe						
Isobutylene	1974 Impala			H	97.6	H	97.6
	1977 Marquis			H	97.6	H	97.6
	1983 Regal			H	97.6	H	97.6
	1990 Lumina			H	97.6	H	97.6
	1990 Probe			H	97.6	H	97.6
Benzene	1974 Impala	L	96.4	L	96.4	L	96.4
	1977 Marquis			L	98.4		
	1983 Regal			L	97.6	L	97.6
	1990 Lumina	L	97.6	L	97.6	L	97.6
	1990 Probe	L	97.6	L	97.6	L	97.6
Toluene	1974 Impala	L	96.4	L	96.4	L	96.4
	1977 Marquis	L	98.4	L	98.4	L	98.4
	1983 Regal	L	97.6	L	97.6	L	97.6
	1990 Lumina	L	97.6	L	97.6	L	97.6
	1990 Probe	L	97.6	L	97.6	L	97.6
m-, p-Xylenes	1974 Impala	L	97.6	L	97.6	L	97.6
	1977 Marquis	L	98.4	L	98.4	L	98.4
	1983 Regal	L	97.6	L	97.6	L	97.6
	1990 Lumina	L	97.6	L	97.6	L	97.6
	1990 Probe	L	97.6	L	97.6	L	97.6

[a] H - Emission rate of compound is higher than for baseline fuel.
L - Emission rate of compound is lower than for baseline fuel.
[b] C.L. - Confidence level.

TABLE 24 (CONT'D). SUMMARY OF RELATIVE EMISSION RATES AND CONFIDENCE LEVELS GREATER THAN 95 PERCENT FOR INDIVIDUAL UNREGULATED EMISSIONS

Compound	Vehicle	10% Ethanol (EM-906-F)		16.4% MTBE (EM-907-F)		19.1% ETBE (EM-908-F)	
		Higher/ Lower[a]	C.L.,%[b]	Higher/ Lower[a]	C.L.,%[b]	Higher/ Lower[a]	C.L.,%[b]
o-Xylene	1974 Impala	L	97.6	L	97.6	L	97.6
	1977 Marquis	L	96.4	L	98.4	L	98.4
	1983 Regal	L	97.6	L	97.6	L	97.6
	1990 Lumina	L	97.6	L	97.6	L	97.6
	1990 Probe	L	96.4	L	96.4	L	96.4
Formaldehyde	1974 Impala			H	95.2		
	1977 Marquis	H	97.6	H	97.6	H	97.6
	1983 Regal						
	1990 Lumina	H	97.6	H	97.6	H	97.6
	1990 Probe						
Acetaldehyde	1974 Impala	H	97.6			H	97.6
	1977 Marquis	H	97.6	H	95.2	H	97.6
	1983 Regal	H	97.6			H	97.6
	1990 Lumina						
	1990 Probe	H	97.6	L	95.2	H	97.6
Total Aldehydes and Ketones	1974 Impala					H	95.2
	1977 Marquis	H	97.6	H	97.6	H	97.6
	1983 Regal	H	97.6				
	1990 Lumina	H	95.2	H	95.2	H	97.6
	1990 Probe						
Ethanol	1974 Impala	H	97.6			H	97.6
	1977 Marquis	H	98.4				
	1983 Regal						
	1990 Lumina						
	1990 Probe	H	97.6				
MTBE	1974 Impala			H	97.6		
	1977 Marquis			H	98.4		
	1983 Regal			H	97.6		
	1990 Lumina			H	97.6		
	1990 Probe			H	97.6		

[a] H - Emission rate of compound is higher than for baseline fuel.
L - Emission rate of compound is lower than for baseline fuel.
[b] C.L. - Confidence level.

TABLE 24 (CONT'D). SUMMARY OF RELATIVE EMISSION RATES AND CONFIDENCE LEVELS GREATER THAN 95 PERCENT FOR INDIVIDUAL UNREGULATED EMISSIONS

Compound	Vehicle	10% Ethanol (EM-906-F)		16.4% MTBE (EM-907-F)		19.1% ETBE (EM-908-F)	
		Higher/ Lower[a]	C.L.,%[b]	Higher/ Lower[a]	C.L.,%[b]	Higher/ Lower[a]	C.L.,%[b]
N_2O	1974 Impala						
	1977 Marquis						
	1983 Regal						
	1990 Lumina						
	1990 Probe						
Evaporative MTBE	1974 Impala			H	97.6		
	1977 Marquis			H	97.6		
	1983 Regal			H	97.6		
	1990 Lumina			H	97.6		
	1990 Probe			H	95.2		
Evaporative Benzene	1974 Impala						
	1977 Marquis	H	97.6	H	97.6	H	97.6
	1983 Regal					L	97.6
	1990 Lumina						
	1990 Probe						
Evaporative Ethanol	1974 Impala	H	97.6				
	1977 Marquis	H	97.6				
	1983 Regal	H	97.6				
	1990 Lumina	H	95.2				
	1990 Probe						

[a] H - Emission rate of compound is higher than for baseline fuel.
L - Emission rate of compound is lower than for baseline fuel.
[b] C.L. - Confidence level.

TABLE 25. SUMMARY OF SIGNIFICANT UNREGULATED EMISSIONS DIFFERENCES BETWEEN THE BASELINE FUEL AND THE 10% ETHANOL BLEND PRODUCED BY THREE OR MORE TEST VEHICLES WITH CONFIDENCE LEVELS >95%

All Vehicles				4 of 5 Vehicles				3 of 5 Vehicles			
		Avg. Emissions, mg/mi				Avg. Emissions, mg/test				Avg. Emissions, mg/mi	
Compound	Vehicle	Baseline Fuel	Ethanol Blend	Compound	Vehicle	Baseline Fuel	Ethanol Blend	Compound	Vehicle	Baseline Fuel	Ethanol Blend
Toluene	Impala	986	489	Acetaldehyde	Impala	19.5	26.6	Benzene	Impala	421	332
	Marquis	51.3	23.8		Marquis	10.9	22.4		Lumina	10.7	6.1
	Regal	77.8	32.1		Regal	2.3	7.0		Probe	14.0	8.0
	Lumina	23.5	9.2		Probe	0.8	2.2				
	Probe	37.2	14.1								
m-,p-Xylenes	Impala	453	245	Evaporative Ethanol, mg/test	Impala	11	280	Total Aldehydes & Ketones	Marquis	56.4	84.2
	Marquis	24.5	14.4		Marquis	115	1500		Regal	9.9	16.1
	Regal	33.9	17.5		Regal	10	300		Lumina	6.1	8.7
	Lumina	8.9	3.4		Lumina	5	40				
	Probe	21.8	8.5								
o-Xylene	Impala	205	96.2					Ethanol	Impala	ND[a]	44.8
	Marquis	11.9	8.1						Marquis	ND	3
	Regal	15.6	7.7						Probe	Trace[b]	8.5
	Lumina	4.0	1.1								
	Probe	9.1	4.5								

[a] ND - Not detected. Less than the detection limit.
[b] Trace - Detected but not quantifiable above the detection limit.

TABLE 26. SUMMARY OF SIGNIFICANT UNREGULATED EMISSION DIFFERENCES BETWEEN THE BASELINE FUEL AND THE 16.4% MTBE BLEND PRODUCED BY THREE OR MORE TEST VEHICLES WITH CONFIDENCE LEVELS >95%

All Vehicles				3 of 5 Vehicles			
		Avg. Emissions, mg/mi, except as noted				Avg. Emissions, mg/mi	
Compound	Vehicle	Baseline Fuel	MTBE Blend	Compound	Vehicle	Baseline Fuel	MTBE Blend
Isobutylene	Impala	133	240	Formaldehyde	Impala	84.1	100
	Marquis	8.1	33.6		Marquis	31.7	64.1
	Regal	6.0	16.2		Lumina	3.1	4.3
	Lumina	3.3	7.2				
	Probe	3.5	8.7				
Benzene	Impala	421	240				
	Marquis	17.3	12.6				
	Regal	26.6	18.2				
	Lumina	10.7	5.9				
	Probe	14.0	8.5				
Toluene	Impala	986	346				
	Marquis	51.3	22.4				
	Regal	77.8	23.5				
	Lumina	23.5	8.5				
	Probe	37.2	13.6				
m-,p-Xylenes	Impala	453	174				
	Marquis	245	11.2				
	Regal	33.9	10.9				
	Lumina	8.9	3.7				
	Probe	21.8	9.1				
o-Xylene	Impala	205	64.6				
	Marquis	11.9	5.8				
	Regal	15.6	5.4				
	Lumina	4.0	1.7				
	Probe	9.1	3.4				
MTBE	Impala	1.0	133				
	Marquis	1.5	24.5				
	Regal	Trace[a]	20.7				
	Lumina	ND[b]	4.1				
	Probe	Trace	6.4				
Evaporative MTBE, mg/test	Impala	4	777				
	Marquis	68	1991				
	Regal	8	171				
	Lumina	ND	37				
	Probe	ND	7				

[a] Trace - Detected but not quantifiable above the detection limit.

[b] ND - Not detected. Less than the detection limit.

TABLE 27. SUMMARY OF SIGNIFICANT UNREGULATED EMISSIONS DIFFERENCES BETWEEN THE BASELINE FUEL AND THE 19.1% ETBE BLEND PRODUCED BY THREE OR MORE TEST VEHICLES WITH CONFIDENCE LEVELS >95%

All Vehicles				4 of 5 Vehicles				3 of 5 Vehicles			
		Avg. Emissions, mg/mi				Avg. Emissions, mg/mi				Avg. Emissions, mg/mi	
Compound	Vehicle	Baseline Fuel	ETBE Blend	Compound	Vehicle	Baseline Fuel	ETBE Blend	Compound	Vehicle	Baseline Fuel	ETBE Blend
Isobutylene	Impala	133	250	Benzene	Impala	421	234	Total Aldehydes and Ketones	Impala	152	185
	Marquis	8.1	29.1		Regal	26.6	17.5		Marquis	56.4	116.9
	Regal	6.0	17.2		Lumina	10.7	8.2		Lumina	6.1	9.1
	Lumina	3.3	8.1		Probe	14.0	9.5				
	Probe	3.5	9.6								
Toluene	Impala	986	317	Acetaldehyde	Impala	19.5	47.9				
	Marquis	513	22.5		Marquis	10.9	35.2				
	Regal	77.8	25.7		Regal	2.3	5.1				
	Lumina	23.5	10.8		Probe	0.8	1.8				
	Probe	37.2	16.6								
m-,p-Xylenes	Impala	453	165								
	Marquis	24.5	14.0								
	Regal	33.9	12.6								
	Lumina	8.9	5.2								
	Probe	21.8	9.9								
o-Xylene	Impala	205	62.8								
	Marquis	11.9	7.3								
	Regal	15.6	5.5								
	Lumina	4.0	2.5								
	Probe	9.1	3.1								

VII. QUALITY ASSURANCE

The quality assurance for this program was guided by the QA Plan prepared by SwRI for the EPA, "Quality Assurance Program Plan and Project Plan for Assessment of Unregulated Emissions from Gasoline Oxygenated Blends." This document covers such areas as precision, accuracy, and completeness objectives; sample custody, data reduction, validation, and reporting; internal quality control checks and corrective action; performance and system audits; and preventive maintenance.

A. Quality Audits

Two quality audits were performed by the Department of Quality Assurance and Administration at Southwest Research Institute. The first was conducted on March 2, 1990, and the second was performed on May 23, 1990. The purpose of the audits was to ensure that quality assurance considerations were given appropriate attention and to document compliance with the QA Plan. The findings of the audits indicated that the requirements of the QA Plan were met. Copies of the reports are provided in Appendix F.

B. Completeness of Measurements

The completeness objectives for this program, as described in the QA Plan, were for 95 percent of the required measurements to be completed. Percent completion figures for each of the regulated and unregulated emissions are summarized in Table 28. The 95 percent completion requirement was met or exceeded for each of these emissions. Between 96 and 101 percent of the measurements were completed and reported. More than 100 percent completion was achieved for the regulated exhaust emissions and fuel economy because additional tests were performed on the 1977 Marquis and the 1990 Probe. These extra tests were conducted due to suspected problems with the test protocol or vehicle.

An additional test was performed on the Marquis due to variations observed in CO emission rates. These CO fluctuations may have been due to the choke operating inconsistently, and not to incorrect operation of the vehicle. The test was therefore accepted as valid.

The additional tests with the Probe were performed for the purpose of measuring evaporative emissions. In the initial tests with the ethanol blend, it was determined after the test sequence had been completed that a small fuel leak was occurring from the thermocouple fitting on the fuel tank. The fuel leak did not affect the regulated exhaust emissions and fuel economy measurements. Two additional tests were conducted to obtain evaporative emissions data.

C. Procedures, Calibrations, and Maintenance

The procedures described in previous sections of this report for testing and analysis were followed as specified. Included were necessary periodic calibrations, the analysis of standards, and the performance of maintenance as required. Several additional checks were performed to further ensure the quality of the data. A data sheet was incorporated to document the performance of vehicle prep cycles. Single prep cycles were performed as required between vehicle tests using the same fuel. Triple prep cycles were conducted between tests with fuel changes. The "Vehicle Preparation Verification" data sheets completed for tests on the 1974 Chevrolet Impala are included in Appendix F as an example.

TABLE 28. PERCENT COMPLETION OF MEASUREMENTS

	Completed/Planned Tests by Vehicle						
	1974 Chevrolet Impala	1977 Mercury Marquis	1983 Buick Regal	1990 Chevrolet Lumina	1990 Ford Probe	All Vehicles	Percent Completion
Regulated Emissions & Fuel Economy							
HC	15/15[a]	16/15	15/15	15/15	15/15	76/75	101
CO	15/15	16/15	15/15	15/15	15/15	76/75	101
NO_x	15/15	16/15	15/15	15/15	15/15	76/75	
Fuel Economy	15/15	16/15	15/15	15/15	15/15	76/75	101
Evaporative HC	15/15	16/15	15/15	15/15	14/15	75/75	100
Speciated Hydrocarbons							
Ethylene	15/15	15/15	15/15	15/15	15/15	75/75	100
1,3-Butadiene	15/15	15/15	15/15	15/15	15/15	75/75	100
Isobutylene	15/15	15/15	15/15	15/15	15/15	75/75	100
Benzene	14/15	15/15	15/15	15/15	15/15	74/75	99
Toluene	14/15	15/15	15/15	15/15	15/15	74/75	99
m-, p-Xylenes	15/15	15/15	15/15	15/15	15/15	75/75	100
o-Xylenes	15/15	15/15	15/15	15/15	14/15	74/75	99
Oxygenated Hydrocarbons & N_2O							
Formaldehyde	15/15	15/15	15/15	15/15	15/15	75/75	100
Acetaldehyde	15/15	15/15	15/15	15/15	15/15	75/75	100
Total Aldehydes & Ketones	15/15	15/15	15/15	15/15	15/15	75/75	100
Ethanol	15/15	15/15	14/15	15/15	15/15	74/75	99
MTBE	15/15	15/15	15/15	15/15	15/15	75/75	100
N_2O	15/15	15/15	15/15	15/15	15/15	75/75	100
Evaporative Emissions							
MTBE	15/15	15/15	15/15	15/15	14/15	74/75	99
Benzene	14/15	15/15	15/15	15/15	13/15	72/75	96
Ethanol	15/15	15/15	15/15	15/15	14/15	74/75	99

[a] 15/15 - 15 measurements performed/15 measured required.

D. Additional QA Measures

Chain of custody for Tedlar bag samples was verified using labels attached to the bags. Samples of labels from one test are provided in Appendix F. Each person who analyzed the bag was required to initial the label and write the time he or she received the bag. This system provided improved tracking of the bags and minimized problems with missed analyses.

An additional data sheet was prepared for the impinger sampling of aldehydes and ketones and ethanol. This data sheet, presented in Appendix F, provides a space for verifying that the sampling cart leak-checked, that the sample line temperature was set properly, and that sample flow rates were within acceptable ranges. A comment section is also provided for additional explanations.

A Quality Control Checklist was completed for each test and inserted into the data packet. This data sheet addresses deviations in the driver trace, proper performance of the evaporative test sequence, correct test duration and distance driven, and appropriate CVS operating parameters. A copy of this checklist is provided in Appendix F.

E. Interference to Ethanol Analysis

An interference in the analysis of ethanol samples was noted during the course of the program. The interfering peak was subsequently identified as acetonitrile, which was used as the sampling medium for aldehydes. Ethanol and acetonitrile are not completely separated during the GC analysis, and the ethanol was difficult to quantitate when small amounts of ethanol in relation to acetonitrile were present. For this reason, the ethanol values reported, particularly those near the detection limit, are subject to greater variation than typically noted for the analysis.

REFERENCES

1. Code of Federal Regulations, Title 40, Chapter 1, Part 86, Subpart B, Sections applicable to light-duty vehicles.

2. Smith, L.R., et al, "Analytical Procedures for Characterizing Unregulated Emissions from Motor Vehicles," Report EPA-600/2-79-017, prepared under Contract No. 68-02-2497, February 1979.

3. Smith, L.R., "Butadiene Measurement Technology," Final Report EPA 460/3-88-005, prepared under Work Assignment B-1 of Contract No. 68-03-4044, August 1988.

4. Smith, L.R., "Characterization of Exhaust Emissions from Alcohol-Fueled Vehicles," Final Report prepared for the Coordinating Research Council, Inc., CAPE-30-81, May 1985.

APPENDIX A

COMPUTER PRINTOUTS FROM INITIAL FTP TESTS ON FIVE TEST VEHICLES

	Table
1974 Chevrolet Impala	A-1
1977 Mercury Marquis	A-2
1983 Buick Regal	A-3
1990 Chevrolet Lumina	A-4
1990 Ford Probe	A-5

TABLE A-1

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS - BASELINE
PROJECT 08-2809-001

TEST NO. RUN
VEHICLE MODEL 74 CHEVY IMPALA
ENGINE 5.7 L(350. CID) V-8
TRANSMISSION A3

VEHICLE NO.969
DATE 5/ 1/90
BAG CART NO. 2
DYNO NO. 3
CVS NO. 2

TEST WEIGHT 2211. KG(4875. LBS)
ACTUAL ROAD LOAD 11.0 KW(14.7 HP)
GASOLINE EM-995-F
ODOMETER 100969. KM(62739. MILES)

BAROMETER 738.38 MM HG(29.07 IN HG)
RELATIVE HUMIDITY 57. PCT

DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
ABS. HUMIDITY 9.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR .97

BAG RESULTS

BAG NUMBER	1	2	3
DESCRIPTION	COLD TRANSIENT	STABILIZED	HOT TRANSIENT
BLOWER DIF P MM. H2O(IN. H2O)	787.4 (31.0)	787.4 (31.0)	787.4 (31.0)
BLOWER INLET P MM. H2O(IN. H2O)	787.4 (31.0)	787.4 (31.0)	787.4 (31.0)
BLOWER INLET TEMP. DEG. C(DEG. F)	43.3 (110.0)	42.8 (109.0)	42.2 (108.0)
BLOWER REVOLUTIONS	40655.	69397.	40440.
TOT FLOW STD. CU. METRES(SCF)	75.0 (2647.)	128.1 (4523.)	74.7 (2638.)
THC SAMPLE METER/RANGE/PPM	74.7/ 3/ 745.	61.3/ 3/ 611.	75.7/ 3/ 755.
THC BCKGRD METER/RANGE/PPM	1.5/ 3/ 15.	2.0/ 3/ 20.	2.0/ 3/ 20.
CO SAMPLE METER/RANGE/PPM	88.6/ 3/5426.	85.4/ 3/5003.	81.0/ 3/4458.
CO BCKGRD METER/RANGE/PPM	.1/ 3/ 2.	.2/ 3/ 4.	.1/ 3/ 2.
CO2 SAMPLE METER/RANGE/PCT	88.3/ 1/1.6379	91.2/ 14/ .8965	76.9/ 1/1.4199
CO2 BCKGRD METER/RANGE/PCT	2.5/ 1/ .0441	12.9/ 14/ .0434	2.6/ 1/ .0459
NOX SAMPLE METER/RANGE/PPM	87.3/ 2/ 87.3	24.3/ 2/ 24.4	96.9/ 2/ 96.9
NOX BCKGRD METER/RANGE/PPM	.2/ 2/ .2	.2/ 2/ .2	.0/ 2/ .0
DILUTION FACTOR	6.01	9.31	6.98
THC CONCENTRATION PPM	732.	594.	738.
CO CONCENTRATION PPM	5154.	4821.	4252.
CO2 CONCENTRATION PCT	1.6012	.8578	1.3806
NOX CONCENTRATION PPM	87.1	24.2	96.9
THC MASS GRAMS	31.67	43.84	31.79
CO MASS GRAMS	449.84	718.90	369.86
CO2 MASS GRAMS	2197.8	2011.6	1888.6
NOX MASS GRAMS	12.14	5.76	13.46
THC GRAMS/MI	8.92	11.45	8.90
CO GRAMS/MI	126.78	187.78	103.53
CO2 GRAMS/MI	619.4	525.5	528.6
NOX GRAMS/MI	3.42	1.50	3.77
FUEL ECONOMY IN MPG	10.47	10.35	12.32
RUN TIME SECONDS	507.	866.	505.
MEASURED DISTANCE MI	3.55	3.83	3.57
SCF, DRY	.966	.973	.968

COMPOSITE RESULTS

TEST NUMBER		
BAROMETER	MM HG	738.4
HUMIDITY	G/KG	9.9
TEMPERATURE	DEG C	22.2

		3-BAG	(4-BAG
CARBON DIOXIDE	G/MI	545.8	(.0
FUEL ECONOMY	MPG	10.85	(.00
HYDROCARBONS (THC)	G/MI	10.23	(.00
CARBON MONOXIDE	G/MI	151.98	(.00
OXIDES OF NITROGEN	G/MI	2.52	(.00

TABLE A-2

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 0 RUN 1
VEHICLE MODEL 77 MERCURY MARQUIS
ENGINE 5.7 L(351. CID) V-8
TRANSMISSION A3

VEHICLE NO.862
DATE 3/ 8/90
BAG CART NO. 2
DYNO NO. 3
CVS NO. 2

TEST WEIGHT 2041. KG(4500. LBS)
ACTUAL ROAD LOAD 10.4 KW(14.0 HP)
GASOLINE EM-995-F
ODOMETER 131450. KM(81679. MILES)

BAROMETER 740.41 MM HG(29.15 IN HG)
RELATIVE HUMIDITY 63. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 13.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.08

BAG RESULTS

BAG NUMBER	1	2	3
DESCRIPTION	COLD TRANSIENT	STABILIZED	HOT TRANSIENT
BLOWER DIF P MM. H20(IN. H20)	774.7 (30.5)	782.3 (30.8)	782.3 (30.8)
BLOWER INLET P MM. H20(IN. H20)	772.2 (30.4)	779.8 (30.7)	779.8 (30.7)
BLOWER INLET TEMP. DEG. C(DEG. F)	43.3 (110.0)	43.3 (110.0)	43.3 (110.0)
BLOWER REVOLUTIONS	40480.	69441.	40435.
TOT FLOW STD. CU. METRES(SCF)	75.0 (2650.)	128.6 (4540.)	74.9 (2644.)
THC SAMPLE METER/RANGE/PPM	15.8/ 3/ 158.	71.1/ 2/ 70.	11.2/ 3/ 112.
THC BCKGRD METER/RANGE/PPM	1.5/ 3/ 15.	14.0/ 2/ 14.	1.3/ 3/ 13.
CO SAMPLE METER/RANGE/PPM	66.7/ 13/ 159.	4.0/ 12/ 4.	8.8/ 12/ 8.
CO BCKGRD METER/RANGE/PPM	.2/ 13/ 0.	.4/ 12/ 0.	.3/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	35.6/ 2/1.8763	23.2/ 2/1.2088	89.2/ 1/1.6553
CO2 BCKGRD METER/RANGE/PCT	.9/ 2/ .0460	.9/ 2/ .0460	2.7/ 1/ .0476
NOX SAMPLE METER/RANGE/PPM	46.3/ 2/ 46.3	23.0/ 2/ 23.1	53.7/ 2/ 53.7
NOX BCKGRD METER/RANGE/PPM	.1/ 2/ .1	.2/ 2/ .2	.0/ 2/ .0
DILUTION FACTOR	7.03	11.02	8.04
THC CONCENTRATION PPM	145.	58.	100.
CO CONCENTRATION PPM	150.	3.	8.
CO2 CONCENTRATION PCT	1.8369	1.1670	1.6136
NOX CONCENTRATION PPM	46.2	22.9	53.7
THC MASS GRAMS	6.26	4.28	4.33
CO MASS GRAMS	13.08	.50	.68
CO2 MASS GRAMS	2523.5	2747.1	2211.8
NOX MASS GRAMS	7.16	6.07	8.30
THC GRAMS/MI	1.74	1.10	1.20
CO GRAMS/MI	3.64	.13	.19
CO2 GRAMS/MI	702.1	703.4	613.6
NOX GRAMS/MI	1.99	1.55	2.30
FUEL ECONOMY IN MPG	12.43	12.54	14.36
RUN TIME SECONDS	505.	867.	505.
MEASURED DISTANCE MI	3.59	3.91	3.60
SCF, DRY	.962	.968	.964

COMPOSITE RESULTS

TEST NUMBER		0
BAROMETER	MM HG	740.4
HUMIDITY	G/KG	13.0
TEMPERATURE	DEG C	25.0

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	678.5	(.0)
FUEL ECONOMY	MPG	12.97	(.00)
HYDROCARBONS (THC)	G/MI	1.26	(.00)
CARBON MONOXIDE	G/MI	.87	(.00)
OXIDES OF NITROGEN	G/MI	1.85	(.00)

TABLE A-3

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS - BASELINE
PROJECT 08-2809-001

TEST NO. RUN
VEHICLE MODEL 83 BUICK REGAL
ENGINE 3.8 L(232. CID) V-8
TRANSMISSION A3

BAROMETER 743.71 MM HG(29.28 IN HG)
RELATIVE HUMIDITY 27. PCT

VEHICLE NO.691
DATE 4/ 3/90
BAG CART NO. 2
DYNO NO. 3
CVS NO. 2
DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
ABS. HUMIDITY 4.9 GM/KG

TEST WEIGHT 1814. KG(4000. LBS)
ACTUAL ROAD LOAD 8.4 KW(11.3 HP)
GASOLINE EM-995-F
ODOMETER 133587. KM(83007. MILES)

NOX HUMIDITY CORRECTION FACTOR .84

BAG RESULTS

BAG NUMBER	1	2	3
DESCRIPTION	COLD TRANSIENT	STABILIZED	HOT TRANSIENT
BLOWER DIF P MM. H2O(IN. H2O)	800.1 (31.5)	800.1 (31.5)	800.1 (31.5)
BLOWER INLET P MM. H2O(IN. H2O)	787.4 (31.0)	787.4 (31.0)	787.4 (31.0)
BLOWER INLET TEMP. DEG. C(DEG. F)	42.8 (109.0)	41.1 (106.0)	42.2 (108.0)
BLOWER REVOLUTIONS	40474.	69499.	40428.
TOT FLOW STD. CU. METRES(SCF)	75.3 (2658.)	129.7 (4578.)	75.3 (2658.)
THC SAMPLE METER/RANGE/PPM	21.6/ 3/ 215.	27.9/ 2/ 28.	71.6/ 2/ 71.
THC BCKGRD METER/RANGE/PPM	1.0/ 3/ 10.	9.7/ 2/ 10.	10.8/ 2/ 11.
CO SAMPLE METER/RANGE/PPM	91.0/ 1/ 940.	64.7/ 12/ 64.	59.0/ 1/ 522.
CO BCKGRD METER/RANGE/PPM	.1/ 1/ 1.	.4/ 12/ 0.	.1/ 1/ 1.
CO2 SAMPLE METER/RANGE/PCT	80.7/ 1/1.4921	86.2/ 14/ .7808	70.6/ 1/1.3008
CO2 BCKGRD METER/RANGE/PCT	2.8/ 1/ .0494	13.3/ 14/ .0450	2.6/ 1/ .0459
NOX SAMPLE METER/RANGE/PPM	74.2/ 2/ 74.2	32.3/ 2/ 32.3	64.0/ 2/ 64.0
NOX BCKGRD METER/RANGE/PPM	.1/ 2/ .1	.1/ 2/ .1	.2/ 2/ .2
DILUTION FACTOR	8.35	16.97	9.87
THC CONCENTRATION PPM	207.	19.	61.
CO CONCENTRATION PPM	904.	62.	504.
CO2 CONCENTRATION PCT	1.4486	.7385	1.2595
NOX CONCENTRATION PPM	74.1	32.2	63.8
THC MASS GRAMS	8.97	1.39	2.66
CO MASS GRAMS	79.25	9.39	44.16
CO2 MASS GRAMS	1996.6	1752.9	1735.6
NOX MASS GRAMS	8.96	6.72	7.71
THC GRAMS/MI	2.50	.36	.74
CO GRAMS/MI	22.06	2.45	12.29
CO2 GRAMS/MI	555.9	456.9	483.0
NOX GRAMS/MI	2.49	1.75	2.15
FUEL ECONOMY IN MPG	14.82	19.20	17.57
RUN TIME SECONDS	505.	868.	505.
MEASURED DISTANCE MI	3.59	3.84	3.59
SCF, DRY	.977	.984	.979

COMPOSITE RESULTS

TEST NUMBER		
BAROMETER	MM HG	743.7
HUMIDITY	G/KG	4.9
TEMPERATURE	DEG C	23.3

		3-BAG	(4-BAG
CARBON DIOXIDE	G/MI	484.7	(.0
FUEL ECONOMY	MPG	17.66	(.00
HYDROCARBONS (THC)	G/MI	.91	(.00
CARBON MONOXIDE	G/MI	9.24	(.00
OXIDES OF NITROGEN	G/MI	2.01	(.00

TABLE A-4

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           SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                      FTP   - VEHICLE EMISSIONS RESULTS -
                            PROJECT 08-2509-001

TEST NO.   1            RUN   1           VEHICLE NO.400                      TEST WEIGHT  1588. KG  3500. LBS
VEHICLE MODEL   90 CHEV. LUMINA           DATE    1/31/92                     ACTUAL ROAD LOAD   4.2 KW   5.6 HP
ENGINE 2.5 L(153. CID) L-4                BAG CART NO.  2                     GASOLINE  EM-946-F
TRANSMISSION A3                           DYNO NO.      3                     ODOMETER   5457. KM   3391. MILES
                                          CVS NO.   2
BAROMETER  740.92 MM HG(29.17 IN HG)      DRY BULB TEMP. 23.3 DEG C 74.0 DEG F
RELATIVE HUMIDITY  44. PCT                ABS. HUMIDITY  8.0 GM/KG            NOX HUMIDITY CORRECTION FACTOR   .92
BAG RESULTS
  BAG NUMBER                                   1                 2                 3
  DESCRIPTION                           COLD TRANSIENT       STABILIZED      HOT TRANSIENT

  BLOWER DIF P MM. H2O(IN. H2O)          715.8 (28.2)      723.9 (28.5)      715.8 (28.2)
  BLOWER INLET P MM. H2O(IN. H2O)        713.7 (28.1)      716.8 (28.2)      711.2 (28.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)       43.3 (110.0)      42.2 (108.0)      42.8 (109.0)
  BLOWER REVOLUTIONS                       40525.            69566.            40482.
  TOT FLOW STD. CU. METRES(SCF)           75.8 ( 2677.1)   130.3 ( 4601.1)    75.8 ( 2678.1)
  THC SAMPLE METER/RANGE/PPM          59.3/  2/  59.     10.7/  2/  11.     14.3/  2/  14.
  THC BCKGRD METER/RANGE/PPM           7.9/  2/   8.      9.0/  2/   9.      9.0/  2/   9.
  CO  SAMPLE METER/RANGE/PPM          62.4/ 14/ 287.     27.7/ 12/  27.     75.8/ 12/  75.
  CO  BCKGRD METER/RANGE/PPM            .0/ 14/   0.       .1/ 12/   0.       .0/ 12/   0.
  CO2 SAMPLE METER/RANGE/PCT          59.7/  1/1.0961    68.2/ 14/ .6625    92.6/ 14/ .9376
  CO2 BCKGRD METER/RANGE/PCT           2.5/  1/ .0441    12.7/ 14/ .0425    13.1/ 14/ .0442
  NOX SAMPLE METER/RANGE/PPM          42.1/  1/ 10.6      7.4/  1/  1.9     28.8/  1/  7.3
  NOX BCKGRD METER/RANGE/PPM            .0/  1/   .0       .0/  1/   .0       .0/  1/   .0
  DILUTION FACTOR                          11.86             20.11             14.16
  THC CONCENTRATION PPM                    52.                2.                6.
  CO  CONCENTRATION PPM                   277.               26.               73.
  CO2 CONCENTRATION PCT                   1.0557             .6220             .8965
  NOX CONCENTRATION PPM                   10.6               1.9               7.3
  THC MASS GRAMS                          2.25               .16               .26
  CO  MASS GRAMS                         24.47              3.37              6.45
  CO2 MASS GRAMS                         1465.5            1483.9            1244.6
  NOX MASS GRAMS                          1.41               .44               .97

  THC  GRAMS/MI                            .63               .04               .07
  CO   GRAMS/MI                           6.79              1.02              1.79
  CO2  GRAMS/MI                          406.7             382.6             346.0
  NOX  GRAMS/MI                            .39               .11               .27
  FUEL ECONOMY IN MPG                    21.14             23.07             25.40
  RUN TIME              SECONDS           505.              868.              505.
  MEASURED DISTANCE     MI                3.60              3.88              3.60
  SCF, DRY                                .976              .980              .977

COMPOSITE RESULTS
  TEST NUMBER             1                                                           3-BAG      4-BAG
  BAROMETER     MM HG  740.9                 CARBON DIOXIDE       G/MI        377.5        .0
  HUMIDITY      G/KG     8.0                 FUEL ECONOMY         MPG         23.22        .00
  TEMPERATURE   DEG C   23.3                 HYDROCARBONS  (THC)  G/MI          .17        .00
                                             CARBON MONOXIDE      G/MI         2.43        .00
                                             OXIDES OF NITROGEN   G/MI          .21        .00
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TABLE A-5

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 0 RUN
VEHICLE MODEL 90 FORD PROBE
ENGINE 3.0 L(183. CID) -6
TRANSMISSION A3

VEHICLE NO.
DATE 5/22/90
BAG CART NO. 1
DYNO NO. 3
CVS NO. 2

TEST WEIGHT 1701. KG(3750. LBS)
ACTUAL ROAD LOAD 6.0 KW(8.1 HP)
GASOLINE EM-995-F
ODOMETER 18569. KM(11538. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)
RELATIVE HUMIDITY 58. PCT

DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
ABS. HUMIDITY 10.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.00

BAG RESULTS

BAG NUMBER	1	2	3
DESCRIPTION	COLD TRANSIENT	STABILIZED	HOT TRANSIENT
BLOWER DIF P MM. H2O(IN. H2O)	838.2 (33.0)	812.8 (32.0)	812.8 (32.0)
BLOWER INLET P MM. H2O(IN. H2O)	838.2 (33.0)	812.8 (32.0)	812.8 (32.0)
BLOWER INLET TEMP. DEG. C(DEG. F)	35.0 (95.0)	37.8 (100.0)	38.3 (101.0)
BLOWER REVOLUTIONS	40453.	69496.	40403.
TOT FLOW STD. CU. METRES(SCF)	75.5 (2667.)	129.5 (4572.)	75.2 (2655.)
THC SAMPLE METER/RANGE/PPM	69.5/ 2/ 70.	12.5/ 2/ 13.	26.3/ 2/ 26.
THC BCKGRD METER/RANGE/PPM	11.1/ 2/ 11.	10.4/ 2/ 10.	10.4/ 2/ 10.
CO SAMPLE METER/RANGE/PPM	77.4/ 11/ 335.	42.6/ 13/ 39.	70.9/ 12/ 160.
CO BCKGRD METER/RANGE/PPM	.1/ 11/ 0.	.1/ 13/ 0.	.4/ 12/ 1.
CO2 SAMPLE METER/RANGE/PCT	70.7/ 3/1.2567	83.8/ 11/ .7949	60.4/ 3/1.0519
CO2 BCKGRD METER/RANGE/PCT	3.1/ 3/ .0487	7.4/ 11/ .0440	3.1/ 3/ .0487
NOX SAMPLE METER/RANGE/PPM	47.6/ 2/ 47.6	50.9/ 1/ 12.8	29.4/ 2/ 29.4
NOX BCKGRD METER/RANGE/PPM	.2/ 2/ .2	.1/ 1/ .0	.2/ 2/ .2
DILUTION FACTOR	10.34	16.75	12.52
THC CONCENTRATION PPM	59.	3.	17.
CO CONCENTRATION PPM	320.	38.	153.
CO2 CONCENTRATION PCT	1.2127	.7536	1.0071
NOX CONCENTRATION PPM	47.4	12.8	29.2
THC MASS GRAMS	2.59	.20	.73
CO MASS GRAMS	28.15	5.73	13.39
CO2 MASS GRAMS	1677.1	1786.4	1386.3
NOX MASS GRAMS	6.85	3.16	4.20
THC GRAMS/MI	.72	.05	.20
CO GRAMS/MI	7.78	1.49	3.72
CO2 GRAMS/MI	463.7	464.2	384.5
NOX GRAMS/MI	1.89	.82	1.17
FUEL ECONOMY IN MPG	18.55	19.00	22.68
RUN TIME SECONDS	505.	867.	505.
MEASURED DISTANCE MI	3.62	3.85	3.61
SCF, DRY	.970	.974	.971

COMPOSITE RESULTS

TEST NUMBER		0
BAROMETER	MM HG	740.7
HUMIDITY	G/KG	10.7
TEMPERATURE	DEG C	23.3

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	442.2	(.0)
FUEL ECONOMY	MPG	19.78	(.00)
HYDROCARBONS (THC)	G/MI	.23	(.00)
CARBON MONOXIDE	G/MI	3.41	(.00)
OXIDES OF NITROGEN	G/MI	1.14	(.00)

APPENDIX B

REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY FROM FIVE TEST VEHICLES OPERATED WITH FOUR FUELS

	Table
1974 Chevrolet Impala	B-1
1977 Mercury Marquis	B-2
1983 Buick Regal	B-3
1990 Chevrolet Lumina	B-4
1990 Ford Probe	B-5

TABLE B-1. 1974 CHEVROLET IMPALA REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY

Fuel	Test No.	Exhaust Emissions, g/mile			Fuel Economy, mi/gal	Evaporative Emissions, g HC		
		HC	CO	NO_x		Diurnal	Hot Soak	Total
Baseline (EM-905-F)	411	9.78	149.8	2.67	11.16	4.08	2.32	6.40
	412	8.67	147.6	2.70	11.32	4.71	2.41	7.12
	413	6.81	138.8	2.86	11.29	2.48	2.51	4.99
	414	7.68	139.1	3.00	11.17	3.42	3.13	6.55
	415	7.50	142.7	2.89	11.13	2.57	2.41	4.98
	416	7.79	145.5	3.01	11.11	2.69	2.94	5.63
	Avg.	8.04	143.9	2.86	11.20	3.33	2.62	5.95
	S.D.	1.04	4.5	0.14	0.09	0.91	0.33	0.88
	C.V.,%	13.0	3.12	5.06	0.78	27.5	12.7	14.8
10% Ethanol (EM-906-F)	421	6.70	130.0	2.78	10.87	2.22	3.05	5.27
	422	8.42	143.1	2.86	10.66	2.75	4.94	7.69
	423	8.45	139.7	2.81	10.74	2.36	2.85	5.21
	Avg.	7.86	137.6	2.82	10.76	2.44	3.61	6.06
	S.D.	1.00	6.8	0.04	0.11	0.27	1.15	1.41
	C.V.,%	12.8	4.95	1.43	0.99	11.3	32.0	23.4
16.4% MTBE (EM-907-F)	431	5.15	104.1	3.01	11.22	1.53	4.01	5.54
	432	6.36	116.9	2.95	11.05	2.95	4.01	6.96
	433	6.40	117.3	2.87	11.00	2.71	3.29	6.00
	Avg.	5.97	112.8	2.94	11.09	2.40	3.77	6.17
	S.D.	0.71	7.5	0.07	0.12	0.76	0.42	0.72
	C.V.,%	11.9	6.66	2.39	1.04	31.7	11.0	11.7
19.1% ETBE (EM-908-F)	441	5.30	108.1	3.04	11.05	3.24	3.54	6.78
	442	5.94	116.8	2.83	11.03	3.83	3.63	7.46
	443	6.65	122.3	2.78	10.95	2.33	2.75	5.08
	Avg.	5.96	115.7	2.88	11.01	3.13	3.31	6.44
	S.D.	0.68	7.2	0.14	0.05	0.76	0.48	1.23
	C.V.,%	11.33	6.21	4.79	0.48	24.1	14.6	19.0

TABLE B-2. 1977 MERCURY MARQUIS REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY

Fuel	Test No.	Exhaust Emissions, g/mi			Fuel Economy, mi/gal	Evaporative Emissions, g HC		
		HC	CO	NO_x		Diurnal	Hot-Soak	Total
Baseline (EM-905-F)	211	0.96	1.54	1.85	13.0	6.71	12.13	18.84
	212	1.00	1.29	1.81	13.1	3.64	14.06	17.70
	213	0.94	1.18	1.84	13.2	6.49	13.39	19.88
	214	0.87	1.49	1.89	12.9	5.85	12.46	18.31
	215	0.82	4.55	1.39	12.8	3.04	15.27	18.31
	216	0.86	3.07	1.43	12.6	5.47	16.69	22.16
	215 R-2	0.82	4.18	1.50	12.9	5.88	13.74	19.62
	Avg.	0.90	2.47	1.67	12.9	5.30	13.96	19.26
	S.D.	0.07	1.44	0.22	0.2	1.41	1.59	1.49
	C.V.,%	7.9	58.4	13.3	1.5	26.6	11.4	7.7
10% Ethanol (EM-906-F)	221	1.17	0.87	1.79	12.7	6.43	20.09	26.52
	222	1.05	1.11	1.87	12.8	7.73	20.77	28.50
	223	1.00	1.45	1.76	12.6	3.13	21.33	24.46
	Avg.	1.07	1.14	1.81	12.7	5.76	20.73	26.49
	S.D.	0.09	0.29	0.06	0.1	2.37	0.62	2.02
	C.V.%	8.2	25.6	3.1	0.8	41.2	3.0	7.6
16.4% MTBE (EM-907-F)	231	0.99	0.61	1.70	12.8	5.10	15.57	20.67
	232	1.21	0.51	1.73	12.5	2.56	16.16	18.72
	233	1.11	0.76	1.71	12.5	2.98	15.57	18.55
	Avg.	1.10	0.63	1.71	12.6	3.55	15.77	19.31
	S.D.	0.11	0.13	0.02	0.2	1.36	0.34	1.18
	C.V.,%	10.0	20.0	0.9	1.6	38.4	2.2	6.1
19.2% ETBE (EM-908-F)	241	1.13	0.76	1.60	12.4	1.66	11.27	12.93
	242	1.20	0.84	1.60	12.3	4.61	14.36	18.97
	243	1.13	0.72	1.55	12.5	3.35	15.57	18.92
	Avg.	1.15	0.77	1.58	12.4	3.21	13.73	16.94
	S.D.	0.04	0.06	0.03	0.1	1.48	2.22	3.47
	C.V.,%	3.5	7.9	1.8	0.8	46.1	16.2	20.5

TABLE B-3. 1983 BUICK REGAL REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY

Fuel	Test No.	Exhaust Emissions, g/mile			Fuel Economy, mi/gal	Evaporative Emissions, g HC		
		HC	CO	NO_x		Diurnal	Hot Soak	Total
Baseline (EM-905-F)	311	0.68	6.14	1.80	19.90	0.77	1.20	1.97
	312	0.80	7.52	1.75	19.54	1.14	1.38	2.52
	313	0.72	8.10	1.79	19.56	0.72	1.31	2.03
	314	0.74	7.10	1.89	19.71	0.89	1.27	2.16
	315	0.90	7.76	1.99	19.50	1.01	1.12	2.13
	316	0.72	6.07	2.07	19.66	0.93	1.23	2.16
	Avg.	0.76	7.12	1.88	19.65	0.91	1.25	2.16
	S.D.	0.08	0.85	0.13	0.15	0.15	0.09	0.19
	C.V.,%	10.4	11.9	6.7	0.8	17.0	7.2	8.9
10% Ethanol (EM-906-F)	321	0.68	4.89	1.95	19.05	0.90	1.56	2.46
	322	0.75	6.37	1.85	18.91	1.49	1.53	3.02
	323	0.91	6.55	1.84	18.98	1.48	1.56	3.04
	Avg.	0.78	5.94	1.88	18.98	1.29	1.55	2.84
	S.D.	0.12	0.91	0.06	0.07	0.34	0.02	0.33
	C.V.,%	15.1	15.3	3.2	0.37	26.2	1.1	11.6
16.4% MTBE (EM-907-F)	331	0.70	5.57	1.86	18.68	0.55	1.26	1.81
	332	0.70	5.39	2.03	18.84	0.73	1.13	1.86
	333	0.65	6.04	1.89	18.80	1.46	1.22	2.68
	Avg.	0.68	5.67	1.93	18.77	0.91	1.20	2.12
	S.D.	0.04	0.34	0.09	0.08	0.48	0.07	0.49
	C.V.,%	5.2	5.9	4.7	0.44	53.0	5.5	23.0
19.1% ETBE (EM-908-F)	341	0.71	5.46	1.99	18.64	0.59	1.22	1.81
	342	0.86	5.88	1.94	18.72	0.81	1.11	1.92
	343	0.71	6.06	1.90	18.82	1.21	1.18	2.39
	Avg.	0.76	5.80	1.94	18.73	0.87	1.17	2.04
	S.D.	0.09	0.31	0.05	0.09	0.31	0.06	0.31
	C.V.,%	11.4	5.3	2.3	0.48	36.1	4.8	15.1

TABLE B-4. 1990 CHEVROLET LUMINA REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY

Fuel	Test No.	Exhaust Emissions, g/mile			Fuel Economy, mi/gal	Evaporative Emissions, g HC		
		HC	CO	NO_x		Diurnal	Hot Soak	Total
Baseline (EM-905-F)	111	0.16	2.65	0.25	23.8	0.15	0.20	0.35
	112	0.19	2.42	0.23	23.7	0.21	0.29	0.50
	113	0.21	2.12	0.30	24.2	0.19	0.29	0.48
	114	0.20	2.71	0.28	24.2	0.16	0.26	0.42
	115	0.18	2.68	0.26	24.2	0.20	0.25	0.45
	116	0.19	2.82	0.22	23.7	0.17	0.27	0.44
	Avg.	0.19	2.57	0.26	24.0	0.18	0.26	0.44
	S.D.	0.02	0.26	0.03	0.3	0.02	0.03	0.05
	C.V.,%	9.2	9.9	11.7	1.3	13.1	12.9	11.9
10% Ethanol (EM-906-F)	121	0.14	2.01	0.25	22.9	0.62	0.30	0.92
	122	0.14	1.93	0.27	23.2	0.25	0.30	0.55
	123	0.15	1.92	0.27	23.1	0.26	0.28	0.54
	Avg.	0.14	1.95	0.26	23.1	0.38	0.29	0.67
	S.D.	0.01	0.05	0.01	0.2	0.21	0.01	0.22
	C.V.,%	4.1	2.5	4.4	0.9	55.5	3.9	32.3
16.4% MTBE (EM-907-F)	131	0.16	1.94	0.24	23.1	0.23	0.29	0.52
	132	0.15	1.99	0.25	23.4	0.23	0.31	0.54
	133	0.18	1.87	0.28	23.9	0.19	0.29	0.48
	Avg.	0.16	1.93	0.26	23.5	0.22	0.30	0.52
	S.D.	0.02	0.06	0.02	0.4	0.02	0.01	0.03
	C.V.,%	9.6	3.1	8.0	1.7	10.5	3.8	6.0
19.1% ETBE (EM-908-F)	141	0.18	1.98	0.21	22.8	0.20	0.31	0.51
	142	0.18	2.13	0.29	22.9	0.14	0.29	0.43
	143	0.20	2.54	0.23	22.7	0.34	0.38	0.72
	Avg.	0.19	2.22	0.24	22.8	0.23	0.33	0.56
	S.D.	0.01	0.29	0.04	0.1	0.10	0.05	0.15
	C.V.,%	6.1	13.1	17.3	0.4	44.6	14.3	27.2

TABLE B-5. 1990 FORD PROBE REGULATED EXHAUST AND EVAPORATIVE EMISSIONS AND FUEL ECONOMY

Fuel	Test No.	Exhaust Emissions, g/mile			Fuel Economy, mi/gal	Evaporative Emissions, g HC		
		HC	CO	NO_x		Diurnal	Hot Soak	Total
Baseline (EM-905-F)	511	0.22	2.98	1.10	19.49	0.14	0.31	0.45
	512	0.23	3.45	1.07	18.89	0.10	0.19	0.29
	513	0.26	4.60	1.17	18.89	0.14	0.25	0.39
	514	0.29	4.87	1.03	19.38	0.30	0.10	0.40
	515	0.30	4.85	1.27	19.13	0.09	0.16	0.25
	516	0.33	4.86	1.00	19.25	0.10	0.18	0.28
	Avg.	0.27	4.27	1.11	19.17	0.15	0.20	0.34
	S.D	0.04	0.84	0.10	0.25	0.08	0.07	0.08
	C.V.,%	15.8	19.6	9.0	1.3	52.6	36.5	23.6
10% Ethanol (EM-906-F)	521	0.17	3.00	1.28	18.09	a	a	a
	522	0.21	2.99	1.46	18.31	a	a	a
	523	0.22	2.83	1.39	18.36	a	a	a
	524	b	b	b	b	0.12	0.27	0.39
	525	b	b	b	b	0.12	0.33	0.45
	Avg.	0.20	2.94	1.38	18.25	0.12	0.30	0.42
	S.D.	0.03	0.10	0.09	0.14	0	--	--
	C.V.,%	13.2	3.2	6.6	0.79	0	--	--
16.4% MTBE (EM-907-F)	531	0.24	3.33	1.21	18.89	0.13	0.25	0.38
	532	0.25	3.69	1.25	18.66	0.13	0.21	0.34
	533	0.23	3.52	1.33	18.19	0.09	0.21	0.30
	Avg.	0.24	3.51	1.26	18.58	0.12	0.22	0.34
	S.D.	0.01	0.18	0.06	0.36	0.02	0.02	0.04
	C.V.,%	4.2	5.1	4.8	1.9	19.3	10.5	11.8
19.1% ETBE (EM-908-F)	541	0.25	4.26	0.99	18.74	0.14	0.19	0.33
	542	0.26	4.03	1.10	18.47	0.14	0.18	0.32
	543	0.35	4.25	1.13	18.65	0.08	0.20	0.28
	Avg.	0.29	4.18	1.07	18.62	0.12	0.19	0.31
	S.D.	0.06	0.13	0.07	0.14	0.03	0.01	0.03
	C.V.,%	19.0	3.1	6.89	0.74	28.9	5.3	8.5

[a] No evaporative emissions data, small leak in fuel tank.
[b] Not reported.

APPENDIX C

COMPUTER PRINTOUTS OF REGULATED EMISSIONS AND FUEL ECONOMY FOR FIVE TEST VEHICLES

COMPUTER PRINTOUTS OF REGULATED EMISSIONS AND FUEL ECONOMY FROM TEST VEHICLE 4, A 1974 CHEVROLET IMPALA

Test Fuel	Test No.	Table C-
Baseline (EM-905-F)	411	1
	412	2
	413	3
	414	4
	415	5
	416	6
10% Ethanol (EM-906-F)	421	7
	422	8
	423	9
16.4% MTBE (EM-907-F)	431	10
	432	11
	433	12
19.1% ETBE (EM-908-F)	441	13
	442	14
	443	15

TABLE C-1

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                SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                             FTP   - VEHICLE EMISSIONS RESULTS -
                                    PROJECT 08-2309-001

TEST NO.    411          RUN              VEHICLE NO.969                   TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA           DATE    5/ 2/90                  ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-905-F
TRANSMISSION A3                           DYNO NO.      3                  ODOMETER 101022. KM( 62772. MILES)

BAROMETER 734.57 MM HG(28.92 IN HG)       DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
RELATIVE HUMIDITY  57. PCT                ABS. HUMIDITY  9.9 GM/KG         NOX HUMIDITY CORRECTION FACTOR   .97
BAG RESULTS
  BAG NUMBER                                  1                 2                3                  4
  DESCRIPTION                          COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)          787.4 (31.0)      774.7 (30.5)     774.7 (30.5)      772.2 (30.4)
  BLOWER INLET P MM. H2O(IN. H2O)        774.7 (30.5)      774.7 (30.5)     774.7 (30.5)      769.6 (30.3)
  BLOWER INLET TEMP. DEG. C(DEG. F)       42.8 (109.0)      42.8 (109.0)     41.7 (107.0)      42.2 (108.0)
  BLOWER REVOLUTIONS                        40444.            69460.           40437.            69405.
  TOT FLOW STD. CU. METRES(SCF)           74.3 ( 2625.)    127.7 ( 4510.)    74.5 ( 2631.)    127.8 ( 4513.)
  THC SAMPLE METER/RANGE/PPM            80.9/   3/ 807.    58.0/   3/ 578.  74.8/   3/ 746.   49.6/   3/ 495.
  THC BCKGRD METER/RANGE/PPM             1.8/   3/  18.     2.2/   3/  22.   1.9/   3/  19.    1.8/   3/  18.
  CO  SAMPLE METER/RANGE/PPM            90.5/   3/5689.    85.4/   3/5003.  79.9/   3/4328.   84.0/   3/4824.
  CO  BCKGRD METER/RANGE/PPM              .1/   3/   2.      .3/   3/   6.    .2/   3/   4.     .5/   3/   9.
  CO2 SAMPLE METER/RANGE/PCT            88.6/   1/1.6437   50.7/   1/ .9280 76.3/   1/1.4085  91.6/  14/ .9066
  CO2 BCKGRD METER/RANGE/PCT             2.6/   1/ .0459    2.5/   1/ .0441  2.7/   1/ .0476  13.1/  14/ .0442
  NOX SAMPLE METER/RANGE/PPM            96.6/   2/ 96.6    27.5/   2/ 27.6  97.5/   2/ 97.5   30.6/   2/ 30.6
  NOX BCKGRD METER/RANGE/PPM              .0/   2/   .0      .0/   2/   .0    .0/   2/   .0     .0/   2/   .0
  DILUTION FACTOR                          6.00              9.26             7.17              9.57
  THC CONCENTRATION PPM                   792.              559.             730.              479.
  CO  CONCENTRATION PPM                  5406.             4818.            4130.             4645.
  CO2 CONCENTRATION PCT                  1.6055             .8887           1.3675             .8670
  NOX CONCENTRATION PPM                   96.6              27.6             97.5              30.6
  THC MASS GRAMS                          33.76             40.94            31.18             35.08
  CO  MASS GRAMS                         467.80            716.29           358.19            691.11
  CO2 MASS GRAMS                        2185.0            2077.9           1865.2            2028.8
  NOX MASS GRAMS                          13.38              6.56            13.54              7.30

  THC  GRAMS/MI                            9.37             10.50             8.72              9.19
  CO   GRAMS/MI                          129.79            183.65           100.20            180.97
  CO2  GRAMS/MI                          606.2             532.8            521.8             531.3
  NOX  GRAMS/MI                            3.71              1.68             3.79              1.91
  FUEL ECONOMY IN MPG                    10.78     10.69    10.60           12.81     11.64     10.72
  RUN TIME              SECONDS          504.               867.            505.               867.
  MEASURED DISTANCE     MI                3.60      7.50     3.90            3.57      7.39      3.82
  SCF, DRY                                .967      .971     .973            .969      .972      .973
       DFC, WET (DRY)                          .870( .854)                        .883( .866)
       TOT VOL (SCM) / SAM BLR (SCM)           202.0/  .00                        202.3/  .00

COMPOSITE RESULTS
  TEST NUMBER          411                                                          3-BAG      (4-BAG)
  BAROMETER     MM HG  734.6                  CARBON DIOXIDE        G/MI            544.9     ( 544.5)
  HUMIDITY      G/KG     9.9                  FUEL ECONOMY          MPG             11.16     ( 11.21)
  TEMPERATURE   DEG C   22.2                  HYDROCARBONS (THC)    G/MI             9.78     (  9.39)
                                              CARBON MONOXIDE       G/MI           149.78     (148.74)
                                              OXIDES OF NITROGEN    G/MI             2.67     (  2.75)
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TABLE C-2

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               SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                   PROJECT 08-2609-001

TEST NO.    412            RUN             VEHICLE NO.969                       TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA            DATE    5/ 3/90                      ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                 BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-905-F
TRANSMISSION A3                            DYNO NO.      3                      ODOMETER 101052. KM( 62791. MILES)

BAROMETER 737.62 MM HG(29.04 IN HG)        DRY BULB TEMP. 21.1 DEG C(70.0 DEG F)
RELATIVE HUMIDITY  60. PCT                 ABS. HUMIDITY  9.7 GM/KG             NOX HUMIDITY CORRECTION FACTOR   .97
BAG RESULTS
   BAG NUMBER                                    1                  2                  3                  4
   DESCRIPTION                             COLD TRANSIENT      STABILIZED        HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)            787.4 (31.0)       787.4 (31.0)       787.4 (31.0)       774.7 (30.5)
   BLOWER INLET P MM. H2O(IN. H2O)          787.4 (31.0)       787.4 (31.0)       767.4 (31.0)       769.6 (30.3)
   BLOWER INLET TEMP. DEG. C(DEG. F)         42.8 (109.0)       42.2 (108.0)       42.8 (109.0)       42.2 (108.0)
   BLOWER REVOLUTIONS                         40636.             69497.             40449.             69468.
   TOT FLOW STD. CU. METRES(SCF)             74.9 ( 2646.)     128.3 ( 4529.)      74.6 ( 2633.)     128.5 ( 4538.)
   THC SAMPLE METER/RANGE/PPM             71.5/   3/ 713.    53.4/   3/ 533.    60.2/   3/ 600.    46.1/   3/ 460.
   THC BCKGRD METER/RANGE/PPM              1.7/   3/  17.     2.4/   3/  24.     1.7/   3/  17.     1.5/   3/  15.
   CO  SAMPLE METER/RANGE/PPM             91.3/   3/5802.    84.5/   3/4688.    78.1/   3/4122.    83.3/   3/4737.
   CO  BCKGRD METER/RANGE/PPM               .1/   3/   2.      .4/   3/   7.      .4/   3/   7.      .1/   3/   2.
   CO2 SAMPLE METER/RANGE/PCT             67.6/   1/1.6244   49.3/   1/ .9019   77.0/   1/1.4218   91.3/  14/ .8990
   CO2 BCKGRD METER/RANGE/PCT              2.6/   1/ .0459    2.5/   1/ .0441    2.4/   1/ .0423   12.5/  14/ .0418
   NOX SAMPLE METER/RANGE/PPM             67.0/   2/ 87.0    28.3/   2/ 28.4    42.2/   3/105.5    27.8/   2/ 27.9
   NOX BCKGRD METER/RANGE/PPM               .1/   2/   .1      .2/   2/   .2      .0/   3/   .0      .0/   2/   .0
   DILUTION FACTOR                             6.05               9.53               7.25               9.70
   THC CONCENTRATION PPM                      699.               511.               586.               446.
   CO  CONCENTRATION PPM                     5510.              4703.              3926.              4563.
   CO2 CONCENTRATION PCT                      1.5861             .8624             1.3853              .8615
   NOX CONCENTRATION PPM                      86.9               28.2              105.5               27.9
   THC MASS GRAMS                             30.04              37.60              25.05              32.90
   CO  MASS GRAMS                            480.63             702.27             340.82             682.73
   CO2 MASS GRAMS                            2175.9             2025.2             1891.4             2027.0
   NOX MASS GRAMS                             12.04               6.68              14.54               6.62

   THC  GRAMS/MI                               8.41               9.63               7.02               8.48
   CO   GRAMS/MI                             134.52             179.90              95.55             176.01
   CO2  GRAMS/MI                              609.0              518.8              530.2              522.6
   NOX  GRAMS/MI                               3.37               1.71               4.08               1.71
   FUEL ECONOMY IN MPG                        10.69      10.79   10.88              12.89      11.81   10.96
   RUN TIME              SECONDS              506.               867.               505.               867.
   MEASURED DISTANCE     MI                    3.57       7.48    3.90               3.57       7.45    3.88
   SCF, DRY                                    .966       .970    .973               .968       .971    .973
        DFC, WET (DRY)                              .873( .856)                           .884( .867)
        TOT VOL (SCM) / SAM BLR (SCM)             203.2/   .00                           203.1/   .00

COMPOSITE RESULTS                                                                              3-BAG      (4-BAG
   TEST NUMBER          412                                   CARBON DIOXIDE         G/MI      540.4     ( 541.6
   BAROMETER    MM HG  737.6                                  FUEL ECONOMY           MPG       11.32     ( 11.35
   HUMIDITY     G/KG     9.7                                  HYDROCARBONS (THC)     G/MI       8.67     (  8.33
   TEMPERATURE  DEG C   21.1                                  CARBON MONOXIDE        G/MI     147.62     (146.39
                                                              OXIDES OF NITROGEN     G/MI       2.70     (  2.70
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TABLE C-5

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                     SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                   FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.    413          RUN                  VEHICLE NO.969                    TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA               DATE    5/10/90
ENGINE 5.7 L(350. CID) V-8                    BAG CART NO. 2 / CVS NO.  2       ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
TRANSMISSION A3                               DYNO NO.      3                   GASOLINE  EM-905-F
                                                                                ODOMETER 101287. KM( 62937. MILES)

BAROMETER 742.44 MM HG(29.23 IN HG)           DRY BULB TEMP. 21.1 DEG C(70.0 DEG F)
RELATIVE HUMIDITY  41. PCT                    ABS. HUMIDITY  6.5 GM/KG
BAG RESULTS                                                                     NOX HUMIDITY CORRECTION FACTOR   .88
   BAG NUMBER                                       1                2                 3                4
   DESCRIPTION                               COLD TRANSIENT     STABILIZED       HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)              784.9 (30.9)     774.7 (30.5)      782.3 (30.8)      782.3 (30.8)
   BLOWER INLET P MM. H2O(IN. H2O)            782.3 (30.8)     774.7 (30.5)      779.8 (30.7)      779.8 (30.7)
   BLOWER INLET TEMP. DEG. C(DEG. F)           43.3 (110.0)     42.8 (109.0)      41.7 (107.0)      42.8 (109.0)
   BLOWER REVOLUTIONS                           40591.            69594.            40492.            69545.
   TOT FLOW STD. CU. METRES(SCF)               75.4 ( 2661.)    129.5 ( 4573.)     75.4 ( 2664.)    129.3 ( 4565.)
   THC SAMPLE METER/RANGE/PPM               56.2/   3/ 560.   41.0/   3/ 409.    46.1/   3/ 460.    34.6/   3/ 345.
   THC BCKGRD METER/RANGE/PPM                 .8/   3/   8.    1.3/   3/  13.     1.0/   3/  10.     1.0/   3/  10.
   CO  SAMPLE METER/RANGE/PPM               86.3/   3/5119.   82.0/   3/4578.    75.8/   3/3870.    79.3/   3/4259.
   CO  BCKGRD METER/RANGE/PPM                 .1/   3/   2.     .3/   3/   6.      .2/   3/   4.      .3/   3/   6.
   CO2 SAMPLE METER/RANGE/PCT               90.1/   1/1.6728  50.9/   1/ .9317   78.0/   1/1.4407   51.4/   1/ .9411
   CO2 BCKGRD METER/RANGE/PCT                2.1/   1/ .0370   2.3/   1/ .0406    2.2/   1/ .0388    2.6/   1/ .0459
   NOX SAMPLE METER/RANGE/PPM               42.6/   3/106.5   32.4/   2/ 32.4    47.5/   3/118.7    36.1/   2/ 36.1
   NOX BCKGRD METER/RANGE/PPM                 .0/   3/   .0     .1/   2/   .1      .0/   3/   .0      .0/   2/   .0
   DILUTION FACTOR                               6.13              9.60              7.32              9.79
   THC CONCENTRATION PPM                        554.              397.              451.              336.
   CO  CONCENTRATION PPM                        4889.             4432.             3711.             4122.
   CO2 CONCENTRATION PCT                        1.6418            .8954            1.4072             .8999
   NOX CONCENTRATION PPM                        106.5             32.4              118.7              36.1
   THC MASS GRAMS                                23.94            29.51              19.52             24.92
   CO  MASS GRAMS                               428.98           668.17             325.87            620.49
   CO2 MASS GRAMS                               2265.4           2122.9             1943.4            2130.1
   NOX MASS GRAMS                                13.47             7.03              15.02              7.84

   THC  GRAMS/MI                                  6.60             7.59               5.48              6.38
   CO   GRAMS/MI                                118.30           171.82              91.48            158.78
   CO2  GRAMS/MI                                 624.8            545.9              545.5             545.1
   NOX  GRAMS/MI                                  3.71             1.81               4.22              2.01
   FUEL ECONOMY IN MPG                          10.89     10.83    10.78             12.82     11.87    11.12
   RUN TIME             SECONDS                 506.               868.              505.               868.
   MEASURED DISTANCE    MI                       3.63      7.51     3.89              3.56      7.47     3.91
   SCF, DRY                                      .972      .976     .979              .974      .977     .979
        DFC, WET (DRY)                              .874( .863)                          .885( .874)
        TOT VOL (SCM) / SAM BLR (SCM)              204.9/   .00                          204.7/   .00

COMPOSITE RESULTS
   TEST NUMBER          413                                                          3-BAG      (4-BAG)
   BAROMETER    MM HG  742.4                    CARBON DIOXIDE       G/MI            562.2      ( 561.9)
   HUMIDITY     G/KG     6.5                    FUEL ECONOMY         MPG             11.29      ( 11.40)
   TEMPERATURE  DEG C   21.1                    HYDROCARBONS (THC)   G/MI             6.81      (  6.45)
                                                CARBON MONOXIDE      G/MI           138.82      (134.99)
                                                OXIDES OF NITROGEN   G/MI             2.86      (  2.92)
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TABLE C-4

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SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
              FTP   - VEHICLE EMISSIONS RESULTS -
                   PROJECT 28-2809-001

TEST NO.    414           RUN   1          VEHICLE NO.969                      TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA            DATE    5/16/90                     ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                 BAG CART NO. 2 / CVS NO.  2         GASOLINE  EM-905-F
TRANSMISSION A3                            DYNO NO.       3                    ODOMETER 101497. KM( 63067. MILES)

BAROMETER 736.85 MM HG(29.01 IN HG)        DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  58. PCT                 ABS. HUMIDITY 10.8 GM/KG            NOX HUMIDITY CORRECTION FACTOR  1.00
BAG RESULTS
  BAG NUMBER                                      1                 2                 3                  4
  DESCRIPTION                              COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)            774.7 (30.5)      774.7 (30.5)      789.9 (31.1)      774.7 (30.5)
  BLOWER INLET P MM. H2O(IN. H2O)          774.7 (30.5)      772.2 (30.4)      787.4 (31.0)      774.7 (30.5)
  BLOWER INLET TEMP. DEG. C(DEG. F)         42.8 (109.0)      42.8 (109.0)      37.8 (100.0)      42.8 (109.0)
  BLOWER REVOLUTIONS                          40517.            69398.            40406.            69413.
  TOT FLOW STD. CU. METRES(SCF)             74.8 ( 2640.)    128.1 ( 4522.)     75.1 ( 2652.)    128.1 ( 4522.)
  THC SAMPLE METER/RANGE/PPM             61.7/   3/ 615.   46.2/   3/ 461.   57.1/   3/ 569.   38.5/   3/ 384.
  THC BCKGRD METER/RANGE/PPM              1.5/   3/  15.    1.9/   3/  19.    2.1/   3/  21.    1.4/   3/  14.
  CO  SAMPLE METER/RANGE/PPM             86.1/   3/5093.   83.0/   3/4700.   75.7/   3/3859.   81.2/   3/4481.
  CO  BCKGRD METER/RANGE/PPM               .2/   3/   4.     .5/   3/   9.     .4/   3/   7.     .1/   3/   2.
  CO2 SAMPLE METER/RANGE/PCT             90.7/   1/1.6844  52.2/   1/ .9560  80.0/   1/1.4788  51.9/   1/ .9504
  CO2 BCKGRD METER/RANGE/PCT              2.7/   1/ .0476   2.7/   1/ .0476   2.8/   1/ .0494   2.5/   1/ .0441
  NOX SAMPLE METER/RANGE/PPM             38.0/   3/ 95.1   30.4/   2/ 30.4   44.2/   3/110.5   33.3/   2/ 33.3
  NOX BCKGRD METER/RANGE/PPM               .0/   3/   .0     .0/   2/   .0     .0/   3/   .0     .1/   2/   .1
  DILUTION FACTOR                             6.10              9.35              7.14              9.57
  THC CONCENTRATION PPM                       603.              444.              551.              371.
  CO  CONCENTRATION PPM                      4833.             4518.             3673.             4315.
  CO2 CONCENTRATION PCT                      1.6446             .9134            1.4363             .9109
  NOX CONCENTRATION PPM                       95.1              30.4             110.5              33.2
  THC MASS GRAMS                             25.85             32.60             23.76             27.28
  CO  MASS GRAMS                            420.56            673.69            321.17            643.31
  CO2 MASS GRAMS                            2250.8            2141.8            1975.3            2135.6
  NOX MASS GRAMS                             13.62              7.47             15.90              8.16

  THC  GRAMS/MI                               7.22              8.43              6.60              6.98
  CO   GRAMS/MI                             117.41            174.20             89.27            164.60
  CO2  GRAMS/MI                              628.4             553.8             549.0             546.4
  NOX  GRAMS/MI                               3.80              1.93              4.42              2.09
  FUEL ECONOMY IN MPG                        10.84     10.71    10.60             12.75     11.74   10.95
  RUN TIME              SECONDS               506.              867.              505.              868.
  MEASURED DISTANCE     MI                    3.58      7.45     3.87              3.60      7.51    3.91
  SCF, DRY                                    .966      .970     .973              .968      .971    .973
       DFC. WET (DRY)                             .872( .856)                          .882( .866)
       TOT VOL (SCM) / SAM BLR (SCM)             202.8/   .00                          203.2/   .00

COMPOSITE RESULTS                                                                           3-BAG      (4-BAG
  TEST NUMBER          414                                  CARBON DIOXIDE       G/MI       567.9      ( 565.7
  BAROMETER    MM HG  736.9                                 FUEL ECONOMY         MPG        11.17      ( 11.28
  HUMIDITY     G/KG    10.8                                 HYDROCARBONS (THC)   G/MI        7.68      (  7.25
  TEMPERATURE  DEG C   23.3                                 CARBON MONOXIDE      G/MI      139.13      (136.40
                                                            OXIDES OF NITROGEN   G/MI        3.00      (  3.04
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TABLE C-5

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                      SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                  FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   415          RUN                 VEHICLE NO.969                       TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA             DATE    5/22/90                      ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                  BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-905-F
TRANSMISSION A3                             DYNO NO.      3                      ODOMETER 101706. KM( 63197. MILES)

BAROMETER 742.19 MM HG(29.22 IN HG)         DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  69. PCT                  ABS. HUMIDITY 11.4 GM/KG             NOX HUMIDITY CORRECTION FACTOR  1.02
BAG RESULTS
  BAG NUMBER                                    1                  2                  3                  4
  DESCRIPTION                             COLD TRANSIENT       STABILIZED       HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)            800.1 (31.5)       787.4 (31.0)       787.4 (31.0)       787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)          800.1 (31.5)       787.4 (31.0)       787.4 (31.0)       787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)         38.9 (102.0)       42.8 (109.0)       42.8 (109.0)       42.2 (108.0)
  BLOWER REVOLUTIONS                          40501.             69426.             40440.             69359.
  TOT FLOW STD. CU. METRES(SCF)             75.6 ( 2669.)      128.9 ( 4551.)      75.1 ( 2651.)      128.9 ( 4551.)
  THC SAMPLE METER/RANGE/PPM             59.4/   3/ 592.    44.1/   3/ 440.    54.6/   3/ 544.    38.8/   3/ 387.
  THC BCKGRD METER/RANGE/PPM              1.2/   3/  12.     1.9/   3/  19.     1.4/   3/  14.     1.8/   3/  18.
  CO  SAMPLE METER/RANGE/PPM             86.4/   3/5133.    83.0/   3/4700.    77.1/   3/4011.    80.8/   3/4434.
  CO  BCKGRD METER/RANGE/PPM               .0/   3/   0.      .1/   3/   2.      .2/   3/   4.      .1/   3/   2.
  CO2 SAMPLE METER/RANGE/PCT             87.5/   1/1.6225   51.2/   1/ .9373   77.6/   1/1.4331   52.5/   1/ .9616
  CO2 BCKGRD METER/RANGE/PCT              2.3/   1/ .0406    2.3/   1/ .0406    2.4/   1/ .0423    2.6/   1/ .0459
  NOX SAMPLE METER/RANGE/PPM             87.2/   2/ 87.2    28.9/   2/ 29.0    40.8/   3/102.0    34.3/   2/ 34.3
  NOX BCKGRD METER/RANGE/PPM               .2/   2/   .2      .4/   2/   .4      .0/   3/   .0      .1/   2/   .1
  DILUTION FACTOR                             6.27               9.49               7.27               9.54
  THC CONCENTRATION PPM                       582.               423.               532.               371.
  CO  CONCENTRATION PPM                      4862.              4511.              3811.              4254.
  CO2 CONCENTRATION PCT                      1.5884              .9010             1.3966              .9205
  NOX CONCENTRATION PPM                       87.0               28.6              102.0               34.2
  THC MASS GRAMS                              25.25              31.26              22.93              27.41
  CO  MASS GRAMS                             427.89             676.82             333.04             638.19
  CO2 MASS GRAMS                             2198.5             2126.1             1919.5             2172.0
  NOX MASS GRAMS                              12.87               7.21              14.98               8.63

  THC  GRAMS/MI                               7.12               8.18               6.49               7.07
  CO   GRAMS/MI                             120.60             177.09              94.21             164.51
  CO2  GRAMS/MI                              619.7              556.3              543.0              559.9
  NOX  GRAMS/MI                               3.63               1.89               4.24               2.23
  FUEL ECONOMY IN MPG                        10.89     10.70    10.52              12.73     11.62    10.77
  RUN TIME                 SECONDS           506.               867.               505.               867.
  MEASURED DISTANCE        MI                3.55      7.37     3.82               3.53      7.41     3.88
  SCF, DRY                                   .963      .967     .970               .965      .968     .969
       DFC. WET (DRY)                              .875( .855)                             .883( .864)
       TOT VOL (SCM) / SAM BLR (SCM)              204.5/   .00                            204.0/   .00

COMPOSITE RESULTS                                                                              3-BAG      (4-BAG)
  TEST NUMBER          415                              CARBON DIOXIDE         G/MI       565.8      ( 566.9)
  BAROMETER     MM HG  742.2                            FUEL ECONOMY           MPG        11.13      ( 11.21)
  HUMIDITY      G/KG    11.4                            HYDROCARBONS (THC)     G/MI        7.50      (  7.17)
  TEMPERATURE   DEG C   21.7                            CARBON MONOXIDE        G/MI      142.70      (139.12)
                                                        OXIDES OF NITROGEN     G/MI        2.89      (  2.99)
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TABLE C-6

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        SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                       FTP   - VEHICLE EMISSIONS RESULTS -
                             PROJECT 08-2809-001

TEST NO.   416          RUN                 VEHICLE NO.969                  TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA             DATE    5/23/90                 ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                  BAG CART NO. 2 / CVS NO.  2     GASOLINE  EM-905-F
TRANSMISSION A3                             DYNO NO.      3                 ODOMETER 101740. KM( 63218. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)         DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  45. PCT                  ABS. HUMIDITY  8.9 GM/KG        NOX HUMIDITY CORRECTION FACTOR   .94
BAG RESULTS
  BAG NUMBER                                      1                2                3                 4
  DESCRIPTION                               COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             795.0 (31.3)     784.9 (30.9)     787.4 (31.0)     784.9 (30.9)
  BLOWER INLET P MM. H2O(IN. H2O)           792.5 (31.2)     782.3 (30.8)     787.4 (31.0)     782.3 (30.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)          43.3 (110.0)     42.2 (108.0)     43.3 (110.0)     42.2 (108.0)
  BLOWER REVOLUTIONS                          40465.           69409.           40390.           69348.
  TOT FLOW STD. CU. METRES(SCF)              74.6 ( 2634.)   128.4 ( 4533.)    74.5 ( 2631.)   128.3 ( 4529.)
  THC SAMPLE METER/RANGE/PPM              62.6/  3/ 624.   47.5/  3/ 474.   55.6/  3/ 554.   37.8/  3/ 377.
  THC BCKGRD METER/RANGE/PPM               1.3/  3/  13.    1.3/  3/  13.    1.6/  3/  16.    1.6/  3/  16.
  CO  SAMPLE METER/RANGE/PPM              90.2/  3/5647.   84.4/  3/4875.   76.7/  3/3967.   81.6/  3/4529.
  CO  BCKGRD METER/RANGE/PPM                .0/  3/   0.     .1/  3/   2.     .3/  3/   6.     .7/  3/  13.
  CO2 SAMPLE METER/RANGE/PCT              90.8/  1/1.6864  52.2/  1/ .9560  79.5/  1/1.4693  51.7/  1/ .9467
  CO2 BCKGRD METER/RANGE/PCT               2.8/  1/ .0494   2.7/  1/ .0476   2.8/  1/ .0494   2.8/  1/ .0494
  NOX SAMPLE METER/RANGE/PPM              41.5/  3/103.8   33.5/  2/ 33.5   46.4/  3/115.9   34.4/  2/ 34.4
  NOX BCKGRD METER/RANGE/PPM                .0/  3/   .0     .0/  2/   .0     .1/  3/   .3     .0/  2/   .0
  DILUTION FACTOR                              5.94             9.22             7.14             9.56
  THC CONCENTRATION PPM                       613.             462.             541.             363.
  CO  CONCENTRATION PPM                      5385.            4714.            3795.            4371.
  CO2 CONCENTRATION PCT                      1.6453            .9135           1.4268            .9024
  NOX CONCENTRATION PPM                      103.8             33.5            115.7             34.4
  THC MASS GRAMS                             26.25            34.03            23.11            26.68
  CO  MASS GRAMS                            467.56           704.52           329.13           652.60
  CO2 MASS GRAMS                            2246.7           2147.0           1946.1           2119.0
  NOX MASS GRAMS                             13.96             7.77            15.55             7.97

  THC  GRAMS/MI                               7.25             8.76             6.36             6.94
  CO   GRAMS/MI                             129.08           181.39            90.61           169.71
  CO2  GRAMS/MI                              620.2            552.8            535.7            551.0
  NOX  GRAMS/MI                               3.85             2.00             4.28             2.07
  FUEL ECONOMY IN MPG                        10.70    10.58   10.46            12.97    11.75   10.79
  RUN TIME              SECONDS              505.             867.             505.             867.
  MEASURED DISTANCE     MI                    3.62     7.51    3.88             3.63     7.48    3.85
  SCF. DRY                                    .970     .975    .977             .972     .975    .977
       DFC. WET (DRY)                             .870( .857)                        .882( .869)
       TOT VOL (SCM) / SAM BLR (SCM)             203.0/   .00                       202.8/   .00

COMPOSITE RESULTS                                                                      3-BAG      (4-BAG)
  TEST NUMBER        416                             CARBON DIOXIDE         G/MI       562.1      ( 561.6)
  BAROMETER    MM HG  738.6                          FUEL ECONOMY           MPG        11.11      ( 11.21)
  HUMIDITY     G/KG     8.9                          HYDROCARBONS (THC)     G/MI        7.79      (  7.25)
  TEMPERATURE  DEG C   24.4                          CARBON MONOXIDE        G/MI      145.53      (141.97)
                                                     OXIDES OF NITROGEN     G/MI        3.01      (  3.04)
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TABLE C-7

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                 FTP    - VEHICLE EMISSIONS RESULTS -
                                      PROJECT 08-2809-001

TEST NO.    421          RUN                 VEHICLE NO.969                        TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA              DATE     5/ 4/90                      ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                   BAG CART NO. 2 / CVS NO.  2           GASOLINE  EM-906-F
TRANSMISSION A3                              DYNO NO.       3                      ODOMETER 101118. KM( 62832. MILES)

BAROMETER 742.70 MM HG(29.24 IN HG)          DRY BULB TEMP. 22.8 DEG C(73.0 DEG F)
RELATIVE HUMIDITY  39. PCT                   ABS. HUMIDITY  7.0 GM/KG              NOX HUMIDITY CORRECTION FACTOR   .89
BAG RESULTS
  BAG NUMBER                                       1                  2                  3                  4
  DESCRIPTION                               COLD TRANSIENT        STABILIZED        HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)               787.4 (31.0)       784.9 (30.9)       784.9 (30.9)       784.9 (30.9)
  BLOWER INLET P MM. H2O(IN. H2O)             787.4 (31.0)       782.3 (30.8)       782.3 (30.8)       782.3 (30.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)            42.2 (108.0)       42.2 (108.0)       42.8 (109.0)       42.8 (109.0)
  BLOWER REVOLUTIONS                            40511.             69527.             40451.             69442.
  TOT FLOW STD. CU. METRES(SCF)                75.3 ( 2660.)     129.4 ( 4569.)      75.2 ( 2655.)     129.1 ( 4558.)
  THC SAMPLE METER/RANGE/PPM                52.9/   3/ 528.   37.9/   3/ 378.   44.3/   3/ 442.   32.6/   3/ 325.
  THC BCKGRD METER/RANGE/PPM                 1.2/   3/  12.    1.3/   3/  13.    1.2/   3/  12.    1.1/   3/  11.
  CO  SAMPLE METER/RANGE/PPM                84.8/   3/4926.   78.9/   3/4213.   73.2/   3/3599.   77.2/   3/4022.
  CO  BCKGRD METER/RANGE/PPM                  .3/   3/   6.     .3/   3/   6.     .1/   3/   2.     .3/   3/   6.
  CO2 SAMPLE METER/RANGE/PCT                38.4/   1/1.6399  50.7/   1/ .9280  76.8/   1/1.4180  50.6/   1/ .9261
  CO2 BCKGRD METER/RANGE/PCT                 2.7/   1/ .0476   2.6/   1/ .0459   2.5/   1/ .0441   2.4/   1/ .0423
  NOX SAMPLE METER/RANGE/PPM                39.5/   3/ 98.8   31.1/   2/ 31.1   45.7/   3/114.2   33.5/   2/ 33.5
  NOX BCKGRD METER/RANGE/PPM                  .2/   3/   .5     .0/   2/   .0     .0/   3/   .0     .0/   2/   .0
  DILUTION FACTOR                                6.15               9.68               7.36               9.86
  THC CONCENTRATION PPM                         518.               366.               431.               315.
  CO  CONCENTRATION PPM                        4700.              4078.              3451.              3893.
  CO2 CONCENTRATION PCT                        1.6000              .8869             1.3799              .8881
  NOX CONCENTRATION PPM                         98.4               31.1              114.2               33.5
  THC MASS GRAMS                               23.42              28.47              19.49              24.44
  CO  MASS GRAMS                              412.22             614.21             302.13             585.07
  CO2 MASS GRAMS                              2207.0             2100.9             1899.8             2099.1
  NOX MASS GRAMS                               12.62               6.86              14.62               7.37

  THC  GRAMS/MI                                 6.56               7.43               5.43               6.34
  CO   GRAMS/MI                               115.49             160.22              84.13             151.77
  CO2  GRAMS/MI                                618.4              548.0              529.0              544.5
  NOX  GRAMS/MI                                 3.53               1.79               4.07               1.91
  FUEL ECONOMY IN MPG                          10.36     10.35    10.33              12.54     11.45    10.59
  RUN TIME                 SECONDS             505.               868.               505.               867.
  MEASURED DISTANCE        MI                   3.57      7.40     3.83               3.59      7.45     3.85
  SCF, DRY                                      .971      .976     .978               .974      .977     .978
       DFC. WET (DRY)                                .875( .864)                            .886( .875)
       TOT VOL (SCM) / SAM BLR (SCM)               204.7/   .00                           204.3/   .00

COMPOSITE RESULTS                                                                         3-BAG      (4-BAG)
  TEST NUMBER          421                               CARBON DIOXIDE        G/MI       557.4     ( 556.4)
  BAROMETER     MM HG  742.7                             FUEL ECONOMY          MPG        10.87     ( 10.95)
  HUMIDITY      G/KG     7.0                             HYDROCARBONS (THC)    G/MI        6.70     (  6.38)
  TEMPERATURE   DEG C   22.8                             CARBON MONOXIDE       G/MI      129.97     (127.54)
                                                         OXIDES OF NITROGEN    G/MI        2.78     (  2.81)
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TABLE C-8

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                           FTP   - VEHICLE EMISSIONS RESULTS -
                                PROJECT 08-2809-001

TEST NO.   422          RUN                VEHICLE NO.969                    TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA            DATE    5/ 7/90                   ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                 BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-906-F
TRANSMISSION A3                            DYNO NO.      3                   ODOMETER 101159. KM( 62857. MILES)

BAROMETER 741.93 MM HG(29.21 IN HG)        DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  53. PCT                 ABS. HUMIDITY  8.7 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .94
BAG RESULTS
  BAG NUMBER                                     1                 2                 3                 4
  DESCRIPTION                             COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)            782.3 (30.8)      787.4 (31.0)      787.4 (31.0)      787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)          779.8 (30.7)      787.4 (31.0)      787.4 (31.0)      787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)         42.2 (108.0)      42.8 (109.0)      42.8 (109.0)      42.8 (109.0)
  BLOWER REVOLUTIONS                          40438.            69422.            40448.            69475.
  TOT FLOW STD. CU. METRES(SCF)             75.2 ( 2655.)    128.8 ( 4549.)     75.1 ( 2650.)    128.9 ( 4552.)
  THC SAMPLE METER/RANGE/PPM              66.5/   3/ 663.   48.6/   3/ 465.   53.5/   3/ 534.   38.9/   3/ 388.
  THC BCKGRD METER/RANGE/PPM               1.5/   3/  15.    1.9/   3/  19.    1.6/   3/  16.    1.5/   3/  15.
  CO  SAMPLE METER/RANGE/PPM              89.1/   3/5495.   82.7/   3/4663.   76.3/   3/3924.   79.5/   3/4282.
  CO  BCKGRD METER/RANGE/PPM                .4/   3/   7.     .5/   3/   9.     .3/   3/   6.     .3/   3/   6.
  CO2 SAMPLE METER/RANGE/PCT              87.7/   1/1.6263  49.6/   1/ .9075  76.3/   1/1.4085  91.6/  14/ .9066
  CO2 BCKGRD METER/RANGE/PCT               2.9/   1/ .0512   3.0/   1/ .0530   2.8/   1/ .0494  13.5/  14/ .0458
  NOX SAMPLE METER/RANGE/PPM              40.8/   3/102.0   29.4/   2/ 29.4   43.7/   3/109.2   31.2/   2/ 31.2
  NOX BCKGRD METER/RANGE/PPM                .0/   3/   .0     .0/   2/   .0     .0/   3/   .0     .0/   2/   .0
  DILUTION FACTOR                              6.00              9.46              7.24              9.79
  THC CONCENTRATION PPM                       651.              468.              520.              375.
  CO  CONCENTRATION PPM                      5220.             4492.             3744.             4128.
  CO2 CONCENTRATION PCT                      1.5837             .8601            1.3659             .8655
  NOX CONCENTRATION PPM                      102.0              29.4             109.2              31.2
  THC MASS GRAMS                              29.39             36.19             23.43             29.00
  CO  MASS GRAMS                             456.92            673.75            327.16            619.57
  CO2 MASS GRAMS                             2180.2            2028.7            1877.0            2042.8
  NOX MASS GRAMS                              13.76              6.81             14.71              7.23

  THC  GRAMS/MI                                8.24              9.47              6.58              7.49
  CO   GRAMS/MI                              128.16            176.24             91.91            160.07
  CO2  GRAMS/MI                               611.5             530.7             527.3             527.8
  NOX  GRAMS/MI                                3.86              1.78              4.13              1.87
  FUEL ECONOMY IN MPG                         10.14     10.15    10.16             12.28     11.34    10.59
  RUN TIME             SECONDS                505.               867.              505.              868.
  MEASURED DISTANCE    MI                     3.57      7.39      3.82              3.56      7.43     3.87
  SCF, DRY                                    .967      .972      .974              .969      .972     .974
       DFC, WET (DRY)                               .872( .857)                          .885( .870)
       TOT VOL (SCM) / SAM BLR (SCM)               204.0/   .00                          204.0/   .00

COMPOSITE RESULTS                                                                             3-BAG      (4-BAG
  TEST NUMBER        422                                        CARBON DIOXIDE       G/MI     546.5      ( 545.7
  BAROMETER    MM HG  741.9                                     FUEL ECONOMY         MPG      10.66      ( 10.80
  HUMIDITY     G/KG     8.7                                     HYDROCARBONS (THC)   G/MI      8.42      (  7.84
  TEMPERATURE  DEG C   21.7                                     CARBON MONOXIDE      G/MI    143.09      (138.43
                                                                OXIDES OF NITROGEN   G/MI      2.86      (  2.86
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TABLE C-9

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                  SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                           FTP   - VEHICLE EMISSIONS RESULTS -
                                  PROJECT 08-2809-001

TEST NO.   423          RUN
VEHICLE MODEL   74 CHEVY IMPALA          VEHICLE NO.969                  TEST WEIGHT  2211. KG( 4875. LBS)
ENGINE 5.7 L(350. CID) V-8               DATE    5/ 8/90                 ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
TRANSMISSION A3                          BAG CART NO. 2 / CVS NO.  2     GASOLINE  EM-906-F
                                         DYNO NO.      3                 ODOMETER 101189. KM( 62676. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)      DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
RELATIVE HUMIDITY  69. PCT               ABS. HUMIDITY 11.9 GM/KG
BAG RESULTS                                                              NOX HUMIDITY CORRECTION FACTOR  1.04
  BAG NUMBER
  DESCRIPTION                              1                 2                 3                 4
                                     COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)
  BLOWER INLET P MM. H2O(IN. H2O)     782.3 (30.8)      782.3 (30.8)      782.3 (30.8)      782.3 (30.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)   779.8 (30.7)      779.8 (30.7)      779.8 (30.7)      779.8 (30.7)
  BLOWER REVOLUTIONS                   42.8 (109.0)      42.8 (109.0)      42.8 (109.0)      42.8 (109.0)
  TOT FLOW STD. CU. METRES(SCF)         40502.            69495.            40472.            69500.
  THC SAMPLE METER/RANGE/PPM          74.9 ( 2644.)    128.5 ( 4536.)     74.8 ( 2642.)    128.5 ( 4536.)
  THC BCKGRD METER/RANGE/PPM        62.6/   3/ 624.   48.4/   3/ 483.   61.3/   3/ 611.   41.9/   3/ 418.
  CO  SAMPLE METER/RANGE/PPM         1.3/   3/  13.    2.0/   3/  20.    1.6/   3/  16.    1.5/   3/  15.
  CO  BCKGRD METER/RANGE/PPM        89.3/   3/5522.   82.1/   3/4590.   77.0/   3/4000.   79.7/   3/4305.
  CO2 SAMPLE METER/RANGE/PCT          .2/   3/   4.     .4/   3/   7.     .2/   3/   4.     .1/   3/   2.
  CO2 BCKGRD METER/RANGE/PCT        88.0/   1/1.6321  50.2/   1/ .9187  76.2/   1/1.4066  91.5/  14/ .9040
  NOX SAMPLE METER/RANGE/PPM         2.7/   1/ .0476   2.6/   1/ .0459   2.4/   1/ .0423  13.6/  14/ .0462
  NOX BCKGRD METER/RANGE/PPM        85.9/   2/ 85.9   27.3/   2/ 27.4   40.0/   3/100.0   29.5/   2/ 29.5
  DILUTION FACTOR                     .1/   2/   .1    .1/   2/   .1    .0/   3/   .0    .1/   2/   .1
  THC CONCENTRATION PPM                 6.00              9.45              7.20              9.78
  CO  CONCENTRATION PPM                613.              465.              598.              404.
  CO2 CONCENTRATION PCT               5219.             4398.             3797.             4131.
  NOX CONCENTRATION PPM               1.5924            .8777            1.3701             .8626
  THC MASS GRAMS                       85.8              27.3             100.0              29.5
  CO  MASS GRAMS                       27.59             35.86             26.85             31.20
  CO2 MASS GRAMS                      454.91            657.70            330.72            617.80
  NOX MASS GRAMS                      2182.9            2064.1            1876.6            2028.7
                                       12.80              6.98             14.91              7.54
  THC  GRAMS/MI
  CO   GRAMS/MI                        7.67              9.28              7.40              8.12
  CO2  GRAMS/MI                       126.54            170.11             92.11            160.67
  NOX  GRAMS/MI                       607.2             533.9             522.6             527.6
  FUEL ECONOMY IN MPG                  3.56              1.80              4.15              1.96
  RUN TIME            SECONDS         10.24     10.24   10.24             12.31    11.34    10.56
  MEASURED DISTANCE   MI              505.              868.              505.              868.
  SCF, DRY                            3.59      7.46    3.87              3.59     7.44     3.85
      DFC, WET (DRY)                  .962      .966    .969              .964     .967     .969
      TOT VOL (SCM) / SAM BLR (SCM)        .872( .852)                         .884( .865)
                                          203.3/   .00                         203.3/   .00
COMPOSITE RESULTS
  TEST NUMBER          423                                                      3-BAG      (4-BAG)
  BAROMETER    MM HG  738.6                CARBON DIOXIDE        G/MI           546.0     ( 544.1)
  HUMIDITY     G/KG    11.9                FUEL ECONOMY          MPG            10.74     ( 10.84)
  TEMPERATURE  DEG C   22.2                HYDROCARBONS (THC)    G/MI            8.45     (  8.11)
                                           CARBON MONOXIDE       G/MI          139.67     (136.83)
                                           OXIDES OF NITROGEN    G/MI            2.81     (  2.86)
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TABLE C-10

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                SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   431          RUN               VEHICLE NO.969                    TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA           DATE    5/11/90                   ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-907-F
TRANSMISSION A3                           DYNO NO.      3                   ODOMETER 101356. KM( 62980. MILES)

BAROMETER 736.09 MM HG(28.98 IN HG)       DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  55. PCT                ABS. HUMIDITY 10.1 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .98
BAG RESULTS
  BAG NUMBER                                    1                  2                  3                  4
  DESCRIPTION                             COLD TRANSIENT       STABILIZED        HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)           774.7 (30.5)       774.7 (30.5)       774.7 (30.5)       774.7 (30.5)
   BLOWER INLET P MM. H2O(IN. H2O)         774.7 (30.5)       774.7 (30.5)       774.7 (30.5)       774.7 (30.5)
   BLOWER INLET TEMP. DEG. C(DEG. F)        41.7 (107.0)       41.1 (106.0)       42.2 (108.0)       42.2 (108.0)
   BLOWER REVOLUTIONS                        40508.             69486.             40473.             69429.
   TOT FLOW STD. CU. METRES(SCF)            74.8 ( 2641.)      128.4 ( 4536.)      74.7 ( 2636.)      128.1 ( 4522.)
   THC SAMPLE METER/RANGE/PPM             43.0/   3/ 429.     30.0/   3/ 299.    34.8/   3/ 347.    25.9/   3/ 258.
   THC BCKGRD METER/RANGE/PPM              1.3/   3/  13.      1.8/   3/  18.     1.4/   3/  14.     1.7/   3/  17.
   CO  SAMPLE METER/RANGE/PPM             74.7/   3/3753.     72.4/   3/3518.    65.9/   3/2913.    69.4/   3/3228.
   CO  BCKGRD METER/RANGE/PPM               .0/   3/   0.       .3/   3/   6.      .1/   3/   2.      .2/   3/   4.
   CO2 SAMPLE METER/RANGE/PCT             91.7/   1/1.7039    53.3/   1/ .9765   80.2/   1/1.4826   54.2/   1/ .9933
   CO2 BCKGRD METER/RANGE/PCT              2.7/   1/ .0476     2.7/   1/ .0476    2.7/   1/ .0476    2.5/   1/ .0441
   NOX SAMPLE METER/RANGE/PPM             39.9/   3/ 99.8     31.4/   2/ 31.4    44.5/   3/111.2    35.2/   2/ 35.2
   NOX BCKGRD METER/RANGE/PPM               .0/   3/   .0       .0/   2/   .0      .1/   3/   .3      .1/   2/   .1
   DILUTION FACTOR                              6.26               9.78               7.33               9.90
   THC CONCENTRATION PPM                       418.               283.               335.               243.
   CO  CONCENTRATION PPM                      3560.              3383.              2774.              3104.
   CO2 CONCENTRATION PCT                      1.6638              .9337             1.4414              .9537
   NOX CONCENTRATION PPM                       99.8               31.4              111.0               35.1
   THC MASS GRAMS                             18.75              21.81              15.00              18.67
   CO  MASS GRAMS                            310.05             505.00             241.13             462.85
   CO2 MASS GRAMS                            2278.8             2195.9             1970.4             2236.2
   NOX MASS GRAMS                             13.99               7.57              15.53               8.43

   THC  GRAMS/MI                               5.29               5.58               4.21               4.78
   CO   GRAMS/MI                              87.50             129.48              67.66             118.56
   CO2  GRAMS/MI                              643.1              562.0              552.9              572.8
   NOX  GRAMS/MI                               3.95               1.94               4.36               2.16
   FUEL ECONOMY IN MPG                        10.64      10.74    10.83              12.61      11.69    10.96
   RUN TIME              SECONDS              505.                867.               505.                867.
   MEASURED DISTANCE     MI                   3.54       7.45     3.91               3.56       7.47     3.90
   SCF. DRY                                   .966       .970     .973               .968       .971     .973
        DFC. WET (DRY)                               .877( .861)                            .886( .870)
        TOT VOL (SCM) / SAM BLR (SCM)               203.3/   .00                           202.7/   .00

COMPOSITE RESULTS                                                                         3-BAG       (4-BAG)
   TEST NUMBER         431                                    CARBON DIOXIDE      G/MI    576.1       ( 579.3)
   BAROMETER    MM HG  736.1                                  FUEL ECONOMY        MPG     11.22       ( 11.26)
   HUMIDITY     G/KG    10.1                                  HYDROCARBONS (THC)  G/MI     5.15       (  4.91)
   TEMPERATURE  DEG C   23.3                                  CARBON MONOXIDE     G/MI   104.09       (100.82)
                                                              OXIDES OF NITROGEN  G/MI     3.01       (  3.07)
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TABLE C-11

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                        SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                   FTP   - VEHICLE EMISSIONS RESULTS -
                                         PROJECT 08-2809-001

TEST NO.   432          RUN   1               VEHICLE NO.969                          TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA               DATE    5/14/90                         ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                    BAG CART NO. 2 / CVS NO.  2             GASOLINE  EM-907-F
TRANSMISSION A3                               DYNO NO.       3                        ODOMETER 101398. KM( 63006. MILES)

BAROMETER 738.89 MM HG(29.09 IN HG)           DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
RELATIVE HUMIDITY  73. PCT                    ABS. HUMIDITY 12.7 GM/KG                NOX HUMIDITY CORRECTION FACTOR  1.07
BAG RESULTS
  BAG NUMBER                                        1                  2                  3                  4
  DESCRIPTION                                 COLD TRANSIENT      STABILIZED        HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)               782.3 (30.8)       782.3 (30.8)       782.3 (30.8)       876.3 (34.5)
  BLOWER INLET P MM. H2O(IN. H2O)             779.8 (30.7)       779.8 (30.7)       779.8 (30.7)       495.3 (19.5)
  BLOWER INLET TEMP. DEG. C(DEG. F)            41.7 (107.0)       42.2 (108.0)       41.7 (107.0)       41.7 (107.0)
  BLOWER REVOLUTIONS                           40507.             69511.             40509.             69416.
  TOT FLOW STD. CU. METRES(SCF)                75.1 ( 2650.)     128.7 ( 4543.)      75.1 ( 2650.)     132.3 ( 4670.)
  THC SAMPLE METER/RANGE/PPM                53.9/   3/ 538.    36.8/   3/ 367.    41.2/   3/ 411.    30.0/   3/ 299.
  THC BCKGRD METER/RANGE/PPM                 1.3/   3/  13.     1.8/   3/  18.     1.4/   3/  14.     1.9/   3/  19.
  CO  SAMPLE METER/RANGE/PPM                79.9/   3/4328.    76.4/   3/3935.    70.3/   3/3313.    73.2/   3/3599.
  CO  BCKGRD METER/RANGE/PPM                  .0/   3/   0.      .3/   3/   6.      .4/   3/   7.      .4/   3/   7.
  CO2 SAMPLE METER/RANGE/PCT                80.6/   1/1.6476   52.0/   1/ .9523   78.6/   1/1.4521   52.0/   1/ .9523
  CO2 BCKGRD METER/RANGE/PCT                 2.5/   1/ .0441    2.4/   1/ .0423    2.4/   1/ .0423    2.5/   1/ .0441
  NOX SAMPLE METER/RANGE/PPM                92.1/   2/ 92.1    28.6/   2/ 28.7    97.3/   2/ 97.3    29.3/   2/ 29.3
  NOX BCKGRD METER/RANGE/PPM                  .0/   2/   .0      .3/   2/   .3      .3/   2/   .3      .0/   2/   .0
  DILUTION FACTOR                               6.24               9.64               7.28               9.92
  THC CONCENTRATION PPM                        527.               351.               399.               282.
  CO  CONCENTRATION PPM                       4084.              3762.              3133.              3439.
  CO2 CONCENTRATION PCT                        1.6106              .9143             1.4156              .9126
  NOX CONCENTRATION PPM                        92.1               28.4               97.1               29.3
  THC MASS GRAMS                               23.71              27.08              17.95              22.38
  CO  MASS GRAMS                              356.88             563.55             273.74             529.47
  CO2 MASS GRAMS                             2213.3             2153.8             1945.2             2209.7
  NOX MASS GRAMS                               14.13               7.46              14.89               7.93

  THC  GRAMS/MI                                6.65               6.93               5.04               5.85
  CO   GRAMS/MI                              100.10             144.24              76.92             138.47
  CO2  GRAMS/MI                              620.8              551.3              546.6              577.9
  NOX  GRAMS/MI                                3.96               1.91               4.18               2.07
  FUEL ECONOMY IN MPG                         10.62      10.61    10.61              12.41     11.30    10.42
  RUN TIME               SECONDS              505.                868.               506.               867.
  MEASURED DISTANCE      MI                    3.57       7.47     3.91               3.56      7.38     3.82
  SCF, DRY                                     .960       .964     .967               .962      .965     .967
       DFC, WET (DRY)                                .875( .855)                           .886( .865)
       TOT VOL (SCM) / SAM BLR (SCM)                 283.7/   .00                          287.3/   .00

COMPOSITE RESULTS                                                                                   3-BAG      (4-BAG)
  TEST NUMBER          432                                     CARBON DIOXIDE        G/MI        564.2      ( 572.1)
  BAROMETER    MM HG  738.9                                    FUEL ECONOMY          MPG          11.05     ( 10.99)
  HUMIDITY     G/KG    12.7                                    HYDROCARBONS (THC)    G/MI          6.36     (  6.04)
  TEMPERATURE  DEG C   22.2                                    CARBON MONOXIDE       G/MI        116.89     (114.98)
                                                               OXIDES OF NITROGEN    G/MI          2.95     (  3.00)
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TABLE C-12

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                            FTP   - VEHICLE EMISSIONS RESULTS -
                                  PROJECT 08-2809-001

TEST NO.  433          RUN  1              VEHICLE NO.969                    TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL  74 CHEVY IMPALA             DATE    5/15/90                   ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                 BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-907-F
TRANSMISSION A3                            DYNO NO.      3                   ODOMETER 101431. KM( 63026. MILES)

BAROMETER 737.87 MM HG(29.05 IN HG)        DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  59. PCT                 ABS. HUMIDITY 11.7 GM/KG          NOX HUMIDITY CORRECTION FACTOR  1.03
BAG RESULTS
  BAG NUMBER                                    1                2                3                4
  DESCRIPTION                             COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)           784.9 (30.9)     784.9 (30.9)     774.7 (30.5)     774.7 (30.5)
  BLOWER INLET P MM. H2O(IN. H2O)         782.3 (30.3)     782.3 (30.8)     774.7 (30.5)     774.7 (30.5)
  BLOWER INLET TEMP. DEG. C(DEG. F)        42.2 (108.0)     42.8 (109.0)     42.8 (109.0)     42.2 (108.0)
  BLOWER REVOLUTIONS                        40446.           69439.           40483.           69462.
  TOT FLOW STD. CU. METRES(SCF)           74.7 ( 2638.)   128.2 ( 4525.)    74.8 ( 2641.)   128.5 ( 4537.)
  THC SAMPLE METER/RANGE/PPM           58.1/   3/ 580.   37.3/   3/ 372.   44.0/   3/ 439.   29.4/   3/ 293.
  THC BCKGRD METER/RANGE/PPM            1.6/   3/  16.    1.9/   3/  19.    1.8/   3/  18.    1.6/   3/  16.
  CO  SAMPLE METER/RANGE/PPM           80.9/   3/4446.   75.9/   3/3881.   70.3/   3/3313.   72.7/   3/3548.
  CO  BCKGRD METER/RANGE/PPM             .1/   3/   2.     .4/   3/   7.     .5/   3/   9.     .3/   3/   6.
  CO2 SAMPLE METER/RANGE/PCT           89.8/   1/1.6670  51.9/   1/ .9504  79.2/   1/1.4635  51.8/   1/ .9485
  CO2 BCKGRD METER/RANGE/PCT            2.7/   1/ .0476   2.6/   1/ .0459   2.7/   1/ .0476   2.7/   1/ .0476
  NOX SAMPLE METER/RANGE/PPM           90.6/   2/ 90.6   29.2/   2/ 29.2   39.4/   3/ 98.5   29.8/   2/ 29.8
  NOX BCKGRD METER/RANGE/PPM             .5/   2/   .5     .4/   2/   .4     .3/   3/   .8     .2/   2/   .2
  DILUTION FACTOR                            6.16             9.67             7.22             9.98
  THC CONCENTRATION PPM                      486.             355.             423.             279.
  CO  CONCENTRATION PPM                      4212.            3727.            3146.            3409.
  CO2 CONCENTRATION PCT                      1.6271           .9093            1.4225           .9057
  NOX CONCENTRATION PPM                      90.2             28.9             97.9             29.7
  THC MASS GRAMS                             21.79            27.29            18.99            21.49
  CO  MASS GRAMS                             366.32           555.98           273.92           509.81
  CO2 MASS GRAMS                             2225.5           2133.3           1948.1           2130.3
  NOX MASS GRAMS                             13.32             7.32            14.48             7.54

  THC  GRAMS/MI                              6.13             7.09             5.32             5.59
  CO   GRAMS/MI                              102.98           144.42           76.71            132.63
  CO2  GRAMS/MI                              625.6            554.1            545.6            554.2
  NOX  GRAMS/MI                              3.75             1.90             4.06             1.96
  FUEL ECONOMY IN MPG                        10.51    10.54   10.56            12.42    11.57   10.87
  RUN TIME              SECONDS              505.             868.             506.             868.
  MEASURED DISTANCE     MI                   3.56     7.41    3.85             3.57     7.41    3.84
  SCF, DRY                                   .964     .969    .971             .966     .970    .971
      DFC, WET (DRY)                             .875( .858)                       .886( .869)
      TOT VOL (SCM) / SAM BLR (SCM)             202.9/  .00                       203.3/  .00

COMPOSITE RESULTS                                                                          3-BAG     (4-BAG
  TEST NUMBER       433                                  CARBON DIOXIDE       G/MI         566.6     ( 566.6
  BAROMETER   MM HG  737.9                               FUEL ECONOMY         MPG          11.00     ( 11.10
  HUMIDITY    G/KG    11.7                               HYDROCARBONS (THC)   G/MI          6.40     (  5.96
  TEMPERATURE  DEG C  24.4                               CARBON MONOXIDE      G/MI         117.29    (113.79
                                                         OXIDES OF NITROGEN   G/MI          2.87     (  2.89
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TABLE C-13

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                            FTP   - VEHICLE EMISSIONS RESULTS -
                                 PROJECT 08-2809-001

TEST NO.    441           RUN   1             VEHICLE NO.969                        TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA               DATE    5/17/90                       ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8                    BAG CART NO. 2 / CVS NO.  2           GASOLINE  EM-908-F
TRANSMISSION A3                               DYNO NO.      3                       ODOMETER 101564. KM( 63109. MILES)

BAROMETER 741.93 MM HG(29.21 IN HG)           DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  67. PCT                    ABS. HUMIDITY 13.1 GM/KG              NOX HUMIDITY CORRECTION FACTOR  1.09
BAG RESULTS
   BAG NUMBER
   DESCRIPTION                                      1                  2                  3                  4
                                             COLD TRANSIENT        STABILIZED        HOT TRANSIENT        STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)              787.4 (31.0)       774.7 (30.5)       787.4 (31.0)       774.7 (30.5)
   BLOWER INLET P MM. H2O(IN. H2O)            787.4 (31.0)       774.7 (30.5)       787.4 (31.0)       774.7 (30.5)
   BLOWER INLET TEMP. DEG. C(DEG. F)           43.3 (110.0)       42.2 (108.0)       43.3 (110.0)       43.3 (110.0)
   BLOWER REVOLUTIONS                            40438.             69488.             40447.             69395.
   TOT FLOW STD. CU. METRES(SCF)               75.0 ( 2647.)     129.3 ( 4566.)      75.0 ( 2648.)     128.9 ( 4551.)
   THC SAMPLE METER/RANGE/PPM              42.6/   3/ 425.    30.7/   3/ 306.    36.7/   3/ 366.    25.9/   3/ 258.
   THC BCKGRD METER/RANGE/PPM               1.2/   3/  12.     1.5/   3/  15.     1.3/   3/  13.     1.2/   3/  12.
   CO  SAMPLE METER/RANGE/PPM              75.6/   3/3849.    73.7/   3/3650.    66.5/   3/3145.    70.1/   3/3294.
   CO  BCKGRD METER/RANGE/PPM                .1/   3/   2.      .2/   3/   4.      .1/   3/   2.      .1/   3/   2.
   CO2 SAMPLE METER/RANGE/PCT              92.7/   1/1.7234   53.5/   1/ .9602   80.3/   1/1.4645   53.0/   1/ .9709
   CO2 BCKGRD METER/RANGE/PCT               2.6/   1/ .0459    2.5/   1/ .0441    2.5/   1/ .0441    2.6/   1/ .0459
   NOX SAMPLE METER/RANGE/PPM              37.6/   3/ 94.1    29.0/   2/ 29.0    39.1/   3/ 97.8    29.6/   2/ 29.6
   NOX BCKGRD METER/RANGE/PPM                .0/   3/   .0      .0/   2/   .0      .0/   3/   .0      .1/   2/   .1
   DILUTION FACTOR                                6.20               9.70               7.26              10.06
   THC CONCENTRATION PPM                         415.               293.               355.               248.
   CO  CONCENTRATION PPM                         3633.              3497.              2983.              3158.
   CO2 CONCENTRATION PCT                         1.6849             .9407              1.4465             .9296
   NOX CONCENTRATION PPM                         94.1               29.0               97.8               29.6
   THC MASS GRAMS                                18.63              22.68              15.94              19.11
   CO  MASS GRAMS                               317.08             526.47             260.39             473.87
   CO2 MASS GRAMS                               2312.7             2227.1             1985.7             2193.5
   NOX MASS GRAMS                                14.66               7.81              15.24               7.92

   THC  GRAMS/MI                                  5.19               5.80               4.43               4.98
   CO   GRAMS/MI                                 88.35             134.66              72.31             123.57
   CO2  GRAMS/MI                                 644.4              569.7              551.4              572.0
   NOX  GRAMS/MI                                  4.08               2.00               4.23               2.06
   FUEL ECONOMY IN MPG                           10.59     10.59    10.59              12.47     11.57    10.83
   RUN TIME              SECONDS                 505.               668.               505.               867.
   MEASURED DISTANCE     MI                      3.59      7.50     3.91               3.60      7.44     3.83
   SCF, DRY                                      .962      .966     .969               .964      .967     .969
        DFC. WET (DRY)                                 .876( .857)                           .886( .867)
        TOT VOL (SCM) / SAM BLR (SCM)                 204.3/  .00                           203.9/   .00

COMPOSITE RESULTS
   TEST NUMBER          441                                                                 3-BAG        (4-BAG)
   BAROMETER      MM HG  741.9                          CARBON DIOXIDE        G/MI          580.0       ( 580.7)
   HUMIDITY       G/KG    13.1                          FUEL ECONOMY          MPG           11.05       ( 11.13)
   TEMPERATURE    DEG C   24.4                          HYDROCARBONS (THC)    G/MI           5.30       (  5.06)
                                                        CARBON MONOXIDE       G/MI         108.09       (104.66)
                                                        OXIDES OF NITROGEN    G/MI           3.04       (  3.06)
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TABLE C-14

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SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                 FTP   - VEHICLE EMISSIONS RESULTS -
                        PROJECT 08-2809-001

TEST NO.    442          RUN   1        VEHICLE NO.969                  TEST WEIGHT  2211. KG( 4875. LBS)
VEHICLE MODEL   74 CHEVY IMPALA         DATE     5/16/90                ACTUAL ROAD LOAD  11.0 KW( 14.7 HP)
ENGINE 5.7 L(350. CID) V-8              BAG CART NO. 2 / CVS NO.  2     GASOLINE  EM-908-F
TRANSMISSION A3                         DYNO NO.      3                 ODOMETER 101596. KM( 63129. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)     DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
RELATIVE HUMIDITY  65. PCT              ABS. HUMIDITY 11.2 GM/KG        NOX HUMIDITY CORRECTION FACTOR  1.02
BAG RESULTS
   BAG NUMBER                                 1                2                3                4
   DESCRIPTION                         COLD TRANSIENT      STABILIZED     HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)        774.7 (30.5)      774.7 (30.5)     807.7 (31.8)     774.7 (30.5)
   BLOWER INLET P MM. H2O(IN. H2O)      774.7 (30.5)      774.7 (30.5)     805.2 (31.7)     774.7 (30.5)
   BLOWER INLET TEMP. DEG. C(DEG. F)     43.3 (110.0)      42.8 (109.0)     42.8 (109.0)     42.8 (109.0)
   BLOWER REVOLUTIONS                     40448.            69404.           40420.           69383.
   TOT FLOW STD. CU. METRES(SCF)         75.0 ( 2648.)     128.8 ( 4547.)    74.7 ( 2636.)   128.7 ( 4546.)
   THC SAMPLE METER/RANGE/PPM          46.2/   3/ 461.   35.6/   3/ 355.  38.3/   3/ 382.   28.2/   3/ 281.
   THC BCKGRD METER/RANGE/PPM           1.5/   3/  15.    2.0/   3/  20.   2.0/   3/  20.    1.7/   3/  17.
   CO  SAMPLE METER/RANGE/PPM          79.2/   3/4247.   76.4/   3/3935.  66.8/   3/3172.   72.3/   3/3508.
   CO  BCKGRD METER/RANGE/PPM            .3/   3/   6.     .5/   3/   9.    .5/   3/   9.     .4/   3/   7.
   CO2 SAMPLE METER/RANGE/PCT          90.4/   1/1.6786  51.8/   1/ .9485 78.3/   1/1.4464  52.1/   1/ .9541
   CO2 BCKGRD METER/RANGE/PCT           2.8/   1/ .0494   2.9/   1/ .0512  2.9/   1/ .0512   2.7/   1/ .0476
   NOX SAMPLE METER/RANGE/PPM          93.6/   2/ 93.6   29.3/   2/ 29.3  38.1/   3/ 95.3   29.2/   2/ 29.2
   NOX BCKGRD METER/RANGE/PPM            .3/   2/   .3     .3/   2/   .3    .1/   3/   .3     .0/   2/   .0
   DILUTION FACTOR                         6.21              9.70             7.39             10.01
   THC CONCENTRATION PPM                  448.              337.             365.             266.
   CO  CONCENTRATION PPM                 4012.             3770.            3007.            3362.
   CO2 CONCENTRATION PCT                 1.6371             .9026           1.4022            .9112
   NOX CONCENTRATION PPM                  93.4              29.1             95.1             29.2
   THC MASS GRAMS                         20.14             26.01            16.31            20.52
   CO  MASS GRAMS                        350.26            565.24           261.37           503.84
   CO2 MASS GRAMS                        2247.5            2128.2           1916.7           2147.8
   NOX MASS GRAMS                         13.60              7.27            13.79             7.31

   THC  GRAMS/MI                           5.65              6.77             4.59             5.34
   CO   GRAMS/MI                          98.26            147.00            73.47           131.04
   CO2  GRAMS/MI                          630.5             553.5            538.7            558.6
   NOX  GRAMS/MI                           3.82              1.89             3.88             1.90
   FUEL ECONOMY IN MPG                    10.55    10.53    10.51            12.67    11.65   10.84
   RUN TIME            SECONDS            505.              367.             505.             868.
   MEASURED DISTANCE    MI                3.56     7.41     3.85             3.56     7.40    3.85
   SCF, DRY                               .963     .967     .970             .965     .968    .970
        DFC, WET (DRY)                         .876( .857)                        .887( .869)
        TOT VOL (SCM) / SAM BLR (SCM)          203.8/   .00                       203.4/   .00

COMPOSITE RESULTS                                                                        3-BAG      (4-BA
   TEST NUMBER         442                               CARBON DIOXIDE       G/MI      565.4      ( 566.
   BAROMETER    MM HG  740.7                             FUEL ECONOMY         MPG        11.03     ( 11.1
   HUMIDITY     G/KG    11.2                             HYDROCARBONS (THC)   G/MI        5.94     (  5.51
   TEMPERATURE  DEG C   22.2                             CARBON MONOXIDE      G/MI      116.78     (112.0
                                                         OXIDES OF NITROGEN   G/MI        2.63     (  2.8
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TABLE C-15

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

FTP - VEHICLE EMISSIONS RESULTS -

PROJECT 08-2809-001

TEST NO. 443 RUN 1	VEHICLE NO.969	TEST WEIGHT 2211. KG(4875. LBS)
VEHICLE MODEL 74 CHEVY IMPALA	DATE 5/21/90	ACTUAL ROAD LOAD 18.4 KW(24.7 HP)
ENGINE 5.7 L(350. CID) V-8	BAG CART NO. 2 / CVS NO. 2	GASOLINE EM-908-F
TRANSMISSION A3	DYNO NO. 3	ODOMETER 101640. KM(63156. MILES)
BAROMETER 737.62 MM HG(29.04 IN HG)	DRY BULB TEMP. 23.9 DEG C(75.0 DEG F)	
RELATIVE HUMIDITY 62. PCT	ABS. HUMIDITY 12.0 GM/KG	NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	800.1 (31.5)		787.4 (31.0)	787.4 (31.0)		787.4 (31.0)
BLOWER INLET P MM. H2O(IN. H2O)	800.1 (31.5)		787.4 (31.0)	787.4 (31.0)		787.4 (31.0)
BLOWER INLET TEMP. DEG. C(DEG. F)	37.2 (99.0)		37.8 (100.0)	36.1 (97.0)		36.1 (97.0)
BLOWER REVOLUTIONS	40495.		69517.	40481.		69393.
TOT FLOW STD. CU. METRES(SCF)	75.3 (2660.)		129.4 (4569.)	75.6 (2670.)		129.6 (4577.)
THC SAMPLE METER/RANGE/PPM	48.9/ 3/ 488.		39.2/ 3/ 391.	44.9/ 3/ 448.		29.3/ 3/ 292.
THC BCKGRD METER/RANGE/PPM	1.5/ 3/ 15.		2.1/ 3/ 21.	1.6/ 3/ 16.		1.5/ 3/ 15.
CO SAMPLE METER/RANGE/PPM	81.7/ 3/4541.		77.5/ 3/4055.	70.5/ 3/3332.		73.5/ 3/3629.
CO BCKGRD METER/RANGE/PPM	.1/ 3/ 2.		.4/ 3/ 7.	.3/ 3/ 6.		.2/ 3/ 4.
CO2 SAMPLE METER/RANGE/PCT	88.7/ 1/1.6457		51.2/ 1/ .9373	77.0/ 1/1.4218		51.0/ 1/ .9336
CO2 BCKGRD METER/RANGE/PCT	2.7/ 1/ .0476		2.8/ 1/ .0494	2.7/ 1/ .0476		2.6/ 1/ .0459
NOX SAMPLE METER/RANGE/PPM	89.9/ 2/ 89.9		27.3/ 2/ 27.4	90.8/ 2/ 90.8		28.5/ 2/ 28.6
NOX BCKGRD METER/RANGE/PPM	.0/ 2/ .0		.3/ 2/ .3	.0/ 2/ .0		.0/ 2/ .0
DILUTION FACTOR	6.21		9.66	7.40		10.07
THC CONCENTRATION PPM	475.		372.	434.		279.
CO CONCENTRATION PPM	4300.		3892.	3167.		3486.
CO2 CONCENTRATION PCT	1.6057		.8930	1.3805		.8923
NOX CONCENTRATION PPM	89.9		27.1	90.8		28.6
THC MASS GRAMS	21.44		28.85	19.66		21.65
CO MASS GRAMS	377.11		586.26	278.75		525.97
CO2 MASS GRAMS	2214.5		2115.6	1911.2		2117.4
NOX MASS GRAMS	13.51		6.99	13.69		7.38
THC GRAMS/MI	5.99		7.48	5.56		5.67
CO GRAMS/MI	105.32		151.90	78.83		137.88
CO2 GRAMS/MI	618.4		548.1	540.5		555.1
NOX GRAMS/MI	3.77		1.81	3.87		1.93
FUEL ECONOMY IN MPG	10.55	10.50	10.45	12.42	11.48	10.73
RUN TIME SECONDS	505.		869.	506.		867.
MEASURED DISTANCE MI	3.58	7.44	3.86	3.54	7.35	3.81
SCF, DRY	.964	.968	.971	.966	.969	.971
DFC, WET (DRY)		.875(.858)			.887(.870)	
TOT VOL (SCM) / SAM BLR (SCM)		204.7/ .00			205.2/ .00	

COMPOSITE RESULTS

TEST NUMBER		443
BAROMETER	MM HG	737.6
HUMIDITY	G/KG	12.0
TEMPERATURE	DEG C	23.9

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	560.6	(562.6)
FUEL ECONOMY	MPG	10.95	(11.04)
HYDROCARBONS (THC)	G/MI	6.65	(6.11)
CARBON MONOXIDE	G/MI	122.34	(118.07)
OXIDES OF NITROGEN	G/MI	2.78	(2.82)

COMPUTER PRINTOUTS OF REGULATED EMISSIONS AND FUEL ECONOMY FROM TEST VEHICLE 2, A 1977 MERCURY MARQUIS

Test Fuel	Test No.	Table C-
Baseline (EM-905-F)	211	16
	212	17
	213	18
	214	19
	215	20
	216	21
	215 Run 2	22
10% Ethanol (EM-906-F)	221	23
	222	24
	223	25
16.4% MTBE (EM-907-F)	231	26
	232	27
	233	28
19.1% ETBE (EM-908-F)	241	29
	242	30
	243	31

TABLE C-16

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 211 RUN 1
VEHICLE MODEL 77 MERCURY MARQUIS
ENGINE 5.7 L(351. CID) V-8
TRANSMISSION A3

VEHICLE NO.862
DATE 3/12/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 2041. KG(4500. LBS)
ACTUAL ROAD LOAD 10.4 KW(14.0 HP)
GASOLINE EM-905-F
ODOMETER 131506. KM(81714. MILES)

BAROMETER 739.14 MM HG(29.10 IN HG)
RELATIVE HUMIDITY 66. PCT

DRY BULB TEMP. 23.9 DEG C(75.0 DEG F)
ABS. HUMIDITY 12.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.07

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	764.5 (30.1)		774.7 (30.5)	774.7 (30.5)		774.7 (30.5)
BLOWER INLET P MM. H2O(IN. H2O)	764.5 (30.1)		769.6 (30.3)	769.6 (30.3)		769.6 (30.3)
BLOWER INLET TEMP. DEG. C(DEG. F)	43.3 (110.0)		42.2 (108.0)	43.3 (110.0)		42.8 (109.0)
BLOWER REVOLUTIONS	40482.		69521.	40487.		69563.
TOT FLOW STD. CU. METRES(SCF)	75.0 (2648.)		128.9 (4552.)	74.9 (2646.)		128.9 (4550.)
THC SAMPLE METER/RANGE/PPM	13.3/ 3/ 133.		52.9/ 2/ 52.	85.6/ 2/ 85.		58.7/ 2/ 58.
THC BCKGRD METER/RANGE/PPM	1.3/ 3/ 13.		13.1/ 2/ 13.	12.1/ 2/ 12.		13.1/ 2/ 13.
CO SAMPLE METER/RANGE/PPM	63.6/ 14/ 294.		4.3/ 12/ 4.	10.5/ 12/ 10.		4.1/ 12/ 4.
CO BCKGRD METER/RANGE/PPM	.2/ 14/ 1.		.5/ 12/ 0.	.7/ 12/ 1.		1.0/ 12/ 1.
CO2 SAMPLE METER/RANGE/PCT	36.2/ 2/1.9090		65.6/ 1/1.2067	88.5/ 1/1.6418		64.0/ 1/1.1767
CO2 BCKGRD METER/RANGE/PCT	.9/ 2/ .0460		2.5/ 1/ .0441	2.5/ 1/ .0441		2.7/ 1/ .0476
NOX SAMPLE METER/RANGE/PPM	45.6/ 2/ 45.6		22.8/ 2/ 22.9	52.9/ 2/ 52.9		25.6/ 2/ 25.7
NOX BCKGRD METER/RANGE/PPM	.0/ 2/ .0		.0/ 2/ .0	.1/ 2/ .1		.1/ 2/ .1
DILUTION FACTOR	6.97		11.21	8.23		11.49
THC CONCENTRATION PPM	122.		41.	74.		46.
CO CONCENTRATION PPM	276.		4.	9.		3.
CO2 CONCENTRATION PCT	1.8659		1.1665	1.6031		1.1332
NOX CONCENTRATION PPM	45.6		22.9	52.8		25.6
THC MASS GRAMS	5.23		3.00	3.19		3.42
CO MASS GRAMS	24.12		.53	.78		.43
CO2 MASS GRAMS	2566.8		2753.2	2199.0		2673.5
NOX MASS GRAMS	6.99		6.03	8.09		6.74
THC GRAMS/MI	1.48		.78	.90		.89
CO GRAMS/MI	6.81		.14	.22		.11
CO2 GRAMS/MI	724.6		719.7	619.6		699.3
NOX GRAMS/MI	1.97		1.57	2.28		1.76
FUEL ECONOMY IN MPG	12.24	12.39	12.54	14.54	13.64	12.90
RUN TIME SECONDS	505.		868.	505.		868.
MEASURED DISTANCE MI	3.54	7.37	3.83	3.55	7.37	3.82
SCF, DRY	.962	.966	.968	.964	.967	.968
DFC, WET (DRY)		.891(.872)			.900(.881)	
TOT VOL (SCM) / SAM BLR (SCM)		203.9/ .00			203.8/ .00	

COMPOSITE RESULTS

TEST NUMBER		211
BAROMETER	MM HG	739.1
HUMIDITY	G/KG	12.7
TEMPERATURE	DEG C	23.9

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	693.2	(687.2)
FUEL ECONOMY	MPG	12.96	(13.00)
HYDROCARBONS (THC)	G/MI	.96	(.99)
CARBON MONOXIDE	G/MI	1.54	(1.53)
OXIDES OF NITROGEN	G/MI	1.85	(1.91)

TABLE C-17

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   212          RUN   1                 VEHICLE NO.862                       TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS              DATE     3/13/90                     ACTUAL ROAD LOAD  10.4 KW( 14.0 HP
ENGINE 5.7 L(351. CID) V-8                      BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-905-F
TRANSMISSION A3                                 DYNO NO.       3                     ODOMETER 131535. KM( 81732. MILES)

BAROMETER 735.84 MM HG(28.97 IN HG)             DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
RELATIVE HUMIDITY  64. PCT                      ABS. HUMIDITY 13.6 GM/KG             NOX HUMIDITY CORRECTION FACTOR  1.
BAG RESULTS
   BAG NUMBER                                         1                  2                  3                   4
   DESCRIPTION                                 COLD TRANSIENT       STABILIZED        HOT TRANSIENT        STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)                769.6 (30.3)       769.6 (30.3)       769.6 (30.3)        764.5 (30.1)
   BLOWER INLET P MM. H2O(IN. H2O)              764.5 (30.1)       764.5 (30.1)       764.5 (30.1)        762.0 (30.0)
   BLOWER INLET TEMP. DEG. C(DEG. F)             42.8 (109.0)       42.8 (109.0)       43.3 (110.0)        42.8 (109.0)
   BLOWER REVOLUTIONS                              40462.             69400.             40429.              69431.
   TOT FLOW STD. CU. METRES(SCF)                 74.6 ( 2635.)     128.0 ( 4520.)      74.5 ( 2631.)      128.1 ( 4524.
   THC SAMPLE METER/RANGE/PPM                 14.1/   3/ 141.    53.1/   2/  53.    91.6/   2/  91.     57.0/   2/  56
   THC BCKGRD METER/RANGE/PPM                  1.2/   3/  12.    12.3/   2/  12.    12.5/   2/  12.     13.9/   2/  14
   CO  SAMPLE METER/RANGE/PPM                 54.2/  14/ 244.     4.2/  12/   4.     8.0/  12/   8.      4.5/  12/   4
   CO  BCKGRD METER/RANGE/PPM                   .0/  14/   0.      .1/  12/   0.      .5/  12/   0.      1.8/  12/   2
   CO2 SAMPLE METER/RANGE/PCT                 98.6/   1/1.8394   66.6/   1/1.2255   89.1/   1/1.6534    63.7/   1/1.17
   CO2 BCKGRD METER/RANGE/PCT                  2.4/   1/ .0423    2.7/   1/ .0476    2.3/   1/ .0406     2.4/   1/ .04
   NOX SAMPLE METER/RANGE/PPM                 46.3/   2/ 46.3    20.7/   2/ 20.8    51.7/   2/ 51.7     24.9/   2/ 25.
   NOX BCKGRD METER/RANGE/PPM                   .0/   2/   .0      .1/   2/   .1      .0/   2/   .0       .1/   2/   .
   DILUTION FACTOR                                  7.25              11.04               8.17               11.55
   THC CONCENTRATION PPM                            130.               41.                80.                 44.
   CO  CONCENTRATION PPM                            230.                4.                 7.                  3.
   CO2 CONC NTRATION PCT                           1.8029             1.1822             1.6178              1.1324
   NOX CONCENTRATION PPM                            46.3               20.7               51.7                24.9
   THC MASS GRAMS                                   5.58               3.05               3.41                3.22
   CO  MASS GRAMS                                  20.00                .56                .60                 .39
   CO2 MASS GRAMS                                 2463.6             2770.6             2206.6              2656.3
   NOX MASS GRAMS                                   7.29               5.58               8.13                6.72

   THC  GRAMS/MI                                    1.58                .79                .96                 .83
   CO   GRAMS/MI                                    5.66                .15                .17                 .10
   CO2  GRAMS/MI                                   697.4              722.7              619.4               687.2
   NOX  GRAMS/MI                                    2.06               1.46               2.28                1.74
   FUEL ECONOMY IN MPG                             12.73     12.60     12.49              14.55      13.77    13.13
   RUN TIME             SECONDS                    505.                867.               505.                868.
   MEASURED DISTANCE    MI                          3.53      7.37      3.83               3.56       7.43     3.87
   SCF, DRY                                         .963      .966      .969               .965       .967     .969
        DFC, WET (DRY)                                   .892( .874)                            .900( .882)
        TOT VOL (SCM) / SAM BLR (SCM)                   202.6/   .00                           202.6/   .00

COMPOSITE RESULTS                                                                                      3-BAG       (4-E
   TEST NUMBER          212                                         CARBON DIOXIDE        G/MI         689.1       ( 678
   BAROMETER    MM HG  735.8                                        FUEL ECONOMY          MPG          13.05       ( 13.
   HUMIDITY     G/KG    13.6                                        HYDROCARBONS (THC)    G/MI          1.00       (  1.
   TEMPERATURE  DEG C   25.6                                        CARBON MONOXIDE       G/MI          1.29       (  1.
                                                                    OXIDES OF NITROGEN    G/MI          1.81       (  1.
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TABLE C-18

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 213 RUN 1
VEHICLE MODEL 77 MERCURY MARQUIS
ENGINE 5.7 L(351. CID) V-8
TRANSMISSION A3

VEHICLE NO.862
DATE 3/19/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 2041. KG(4500. LBS)
ACTUAL ROAD LOAD 10.4 KW(14.0 HP)
GASOLINE EM-905-F
ODOMETER 131734. KM(81856. MILES)

BAROMETER 749.30 MM HG(29.50 IN HG)
RELATIVE HUMIDITY 35. PCT

DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
ABS. HUMIDITY 6.8 GM/KG

NOX HUMIDITY CORRECTION FACTOR .89

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	800.1 (31.5)		800.1 (31.5)	800.1 (31.5)		805.2 (31.7)
BLOWER INLET P MM. H2O(IN. H2O)	795.0 (31.3)		795.0 (31.3)	795.0 (31.3)		800.1 (31.5)
BLOWER INLET TEMP. DEG. C(DEG. F)	46.7 (116.0)		43.9 (111.0)	44.4 (112.0)		43.3 (110.0)
BLOWER REVOLUTIONS	40485.		69422.	40422.		69445.
TOT FLOW STD. CU. METRES(SCF)	75.9 (2680.)		129.8 (4584.)	75.5 (2667.)		129.9 (4587.)
THC SAMPLE METER/RANGE/PPM	14.6/ 3/ 146.		40.9/ 2/ 40.	80.2/ 2/ 79.		45.6/ 2/ 45.
THC BCKGRD METER/RANGE/PPM	.8/ 3/ 8.		6.5/ 2/ 6.	7.2/ 2/ 7.		7.7/ 2/ 8.
CO SAMPLE METER/RANGE/PPM	27.9/ 1/ 215.		3.0/ 12/ 3.	11.8/ 12/ 11.		2.2/ 12/ 2.
CO BCKGRD METER/RANGE/PPM	.0/ 1/ 0.		.0/ 12/ 0.	.0/ 12/ 0.		.2/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	34.8/ 2/1.8328		22.9/ 2/1.1929	30.4/ 2/1.5945		63.7/ 1/1.1711
CO2 BCKGRD METER/RANGE/PCT	.9/ 2/ .0460		.9/ 2/ .0460	.9/ 2/ .0460		2.5/ 1/ .0441
NOX SAMPLE METER/RANGE/PPM	58.0/ 2/ 58.0		27.1/ 2/ 27.2	61.3/ 2/ 61.3		31.8/ 2/ 31.8
NOX BCKGRD METER/RANGE/PPM	.0/ 2/ .0		.0/ 2/ .0	.0/ 2/ .0		.1/ 2/ .1
DILUTION FACTOR	7.28		11.36	8.48		11.56
THC CONCENTRATION PPM	139.		35.	73.		38.
CO CONCENTRATION PPM	205.		3.	11.		2.
CO2 CONCENTRATION PCT	1.7931		1.1510	1.5540		1.1300
NOX CONCENTRATION PPM	58.0		27.2	61.3		31.8
THC MASS GRAMS	6.04		2.58	3.17		2.84
CO MASS GRAMS	18.11		.42	.96		.28
CO2 MASS GRAMS	2491.9		2735.8	2148.7		2689.3
NOX MASS GRAMS	7.45		5.97	7.83		6.98
THC GRAMS/MI	1.70		.67	.89		.74
CO GRAMS/MI	5.10		.11	.27		.07
CO2 GRAMS/MI	702.2		709.6	606.0		702.0
NOX GRAMS/MI	2.10		1.55	2.21		1.82
FUEL ECONOMY IN MPG	12.66	12.69	12.72	14.87	13.75	12.86
RUN TIME SECONDS	505.		867.	505.		868.
MEASURED DISTANCE MI	3.55	7.40	3.86	3.55	7.38	3.83
SCF, DRY	.972	.976	.978	.975	.977	.978
DFC, WET (DRY)		.894(.884)			.902(.892)	
TOT VOL (SCM) / SAM BLR (SCM)		205.7/ .00			205.4/ .00	

COMPOSITE RESULTS

TEST NUMBER		213
BAROMETER	MM HG	749.3
HUMIDITY	G/KG	6.8
TEMPERATURE	DEG C	24.4

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	679.8	(677.5)
FUEL ECONOMY	MPG	13.23	(13.27)
HYDROCARBONS (THC)	G/MI	.94	(.96)
CARBON MONOXIDE	G/MI	1.18	(1.17)
OXIDES OF NITROGEN	G/MI	1.84	(1.92)

TABLE C-19

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                SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                             FTP   - VEHICLE EMISSIONS RESULTS -
                                   PROJECT 08-2809-001

TEST NO.   214          RUN   1            VEHICLE NO.862                    TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS         DATE    3/26/90                   ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                 BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-905-F
TRANSMISSION A3                            DYNO NO.      3                   ODOMETER 131960. KM( 81956. MILES)

BAROMETER 750.06 MM HG(29.53 IN HG)        DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
RELATIVE HUMIDITY  33. PCT                 ABS. HUMIDITY  6.5 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .88
BAG RESULTS
   BAG NUMBER                                   1                2                 3                 4
   DESCRIPTION                           COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)          810.3 (31.9)      807.7 (31.8)      807.7 (31.8)      810.3 (31.9)
   BLOWER INLET P MM. H2O(IN. H2O)        807.7 (31.8)      805.2 (31.7)      805.2 (31.7)      807.7 (31.8)
   BLOWER INLET TEMP. DEG. C(DEG. F)       44.4 (112.0)      43.9 (111.0)      44.4 (112.0)      42.8 (109.0)
   BLOWER REVOLUTIONS                        40439.            69439.            40440.            69440.
   TOT FLOW STD. CU. METRES(SCF)           75.5 ( 2666.)    129.8 ( 4584.)     75.5 ( 2667.)    130.0 ( 4592.)
   THC SAMPLE METER/RANGE/PPM            10.5/  3/ 105.    43.5/  2/  43.    87.4/  2/  86.    47.9/  2/  47.
   THC BCKGRD METER/RANGE/PPM              .9/  3/   9.     8.0/  2/   8.     7.6/  2/   8.     8.8/  2/   9.
   CO  SAMPLE METER/RANGE/PPM            60.9/ 14/ 279.     3.2/ 12/   3.    11.6/ 12/  11.     2.6/ 12/   2.
   CO  BCKGRD METER/RANGE/PPM              .1/ 14/   0.      .0/ 12/   0.      .2/ 12/   0.      .4/ 12/   0.
   CO2 SAMPLE METER/RANGE/PCT            35.9/  2/1.8926   66.4/  1/1.2217   87.4/  1/1.6206   63.7/  1/1.1711
   CO2 BCKGRD METER/RANGE/PCT              .9/  2/ .0460    2.5/  1/ .0441    2.4/  1/ .0423    2.5/  1/ .0441
   NOX SAMPLE METER/RANGE/PPM            56.5/  2/ 56.5    28.8/  2/ 28.9    64.5/  2/ 64.5    30.8/  2/ 30.8
   NOX BCKGRD METER/RANGE/PPM              .1/  2/   .1      .0/  2/   .0      .1/  2/   .1      .1/  2/   .1
   DILUTION FACTOR                              7.05             11.09              8.34             11.56
   THC CONCENTRATION PPM                        97.               36.               80.               39.
   CO  CONCENTRATION PPM                       266.                3.               11.                2.
   CO2 CONCENTRATION PCT                      1.8532            1.1816            1.5833            1.1308
   NOX CONCENTRATION PPM                       56.4              28.9              64.4              30.8
   THC MASS GRAMS                               4.20              2.67              3.46              2.94
   CO  MASS GRAMS                              23.38               .45               .93               .31
   CO2 MASS GRAMS                             2562.0            2808.6            2189.7            2692.0
   NOX MASS GRAMS                               7.16              6.30              8.17              6.72

   THC  GRAMS/MI                                1.18               .69               .97               .77
   CO   GRAMS/MI                                6.56               .12               .26               .08
   CO2  GRAMS/MI                               719.4             729.9             616.1             703.6
   NOX  GRAMS/MI                                2.01              1.64              2.30              1.76
   FUEL ECONOMY IN MPG                         12.35     12.36    12.37             14.62    13.63    12.83
   RUN TIME           SECONDS                  505.               868.              505.              868.
   MEASURED DISTANCE    MI                     3.56      7.41     3.85              3.55     7.38     3.83
   SCF, DRY                                    .973      .976     .979              .975     .978     .979
        DFC, WET (DRY)                               .891( .881)                         .901( .892)
        TOT VOL (SCM) / SAM BLR (SCM)               205.3/  .00                         205.6/  .00

COMPOSITE RESULTS                                                                     3-BAG      (4-BAG)
   TEST NUMBER        214                               CARBON DIOXIDE       G/MI      696.6     ( 688.7)
   BAROMETER    MM HG  750.1                            FUEL ECONOMY         MPG       12.91     ( 13.05)
   HUMIDITY     G/KG     6.5                            HYDROCARBONS (THC)   G/MI        .87     (   .89)
   TEMPERATURE  DEG C   25.0                            CARBON MONOXIDE      G/MI       1.49     (  1.48)
                                                        OXIDES OF NITROGEN   G/MI       1.89     (  1.93)
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TABLE C-20

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                         FTP   - VEHICLE EMISSIONS RESULTS -
                              PROJECT 08-2809-001

TEST NO.   215          RUN   1          VEHICLE NO.862                   TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS       DATE    3/30/90                  ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8               BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-905-F
TRANSMISSION A3                          DYNO NO.      3                  ODOMETER 132158. KM( 82119. MILES)

BAROMETER 735.84 MM HG(28.97 IN HG)      DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  56. PCT               ABS. HUMIDITY 11.0 GM/KG         NOX HUMIDITY CORRECTION FACTOR  1.01
BAG RESULTS
   BAG NUMBER                                 1               2                3                4
   DESCRIPTION                          COLD TRANSIENT    STABILIZED     HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)         810.3 (31.9)    810.3 (31.9)     810.3 (31.9)     810.3 (31.9)
   BLOWER INLET P MM. H2O(IN. H2O)       807.7 (31.8)    807.7 (31.8)     807.7 (31.8)     807.7 (31.8)
   BLOWER INLET TEMP. DEG. C(DEG. F)      43.3 (110.0)    43.3 (110.0)     43.3 (110.0)     42.8 (109.0)
   BLOWER REVOLUTIONS                      40533.          69550.           40470.           69518.
   TOT FLOW STD. CU. METRES(SCF)          74.2 ( 2621.)  127.4 ( 4498.)    74.1 ( 2617.)   127.4 ( 4500.)
   THC SAMPLE METER/RANGE/PPM          11.5/   3/ 115.  41.2/   2/ 41.   77.1/   2/ 76.    49.4/   2/ 49.
   THC BCKGRD METER/RANGE/PPM            .8/   3/   8.   6.0/   2/  8.    8.7/   2/  9.     9.0/   2/  9.
   CO  SAMPLE METER/RANGE/PPM          89.0/   1/ 910.  10.4/  12/ 10.   14.4/  12/ 14.     4.7/  12/  4.
   CO  BCKGRD METER/RANGE/PPM            .1/   1/   1.    .3/  12/  0.     .0/  12/  0.      .0/  12/  0.
   CO2 SAMPLE METER/RANGE/PCT          37.8/   2/1.9963 67.3/   1/1.2386 89.7/   1/1.6650  65.0/   1/1.1954
   CO2 BCKGRD METER/RANGE/PCT            .9/   2/ .0460  2.3/   1/ .0406  2.4/   1/ .0423   2.4/   1/ .0423
   NOX SAMPLE METER/RANGE/PPM          94.2/   1/ 23.5  78.3/   1/ 19.6  50.6/   2/ 50.6   26.2/   2/ 26.3
   NOX BCKGRD METER/RANGE/PPM            .3/   1/   .1    .3/   1/   .1    .1/   2/   .1     .0/   2/   .0
   DILUTION FACTOR                         6.49            10.93             8.12            11.32
   THC CONCENTRATION PPM                   106.             34.              69.              41.
   CO  CONCENTRATION PPM                   859.              9.              13.               4.
   CO2 CONCENTRATION PCT                  1.9575           1.2018           1.6279           1.1569
   NOX CONCENTRATION PPM                  23.4             19.5             50.5             26.3
   THC MASS GRAMS                          4.60             2.45             2.92             2.98
   CO  MASS GRAMS                         74.26             1.38             1.14              .64
   CO2 MASS GRAMS                        2660.5           2802.6           2208.9           2699.0
   NOX MASS GRAMS                          3.36             4.81             7.23             6.46

   THC  GRAMS/MI                           1.28              .63              .81              .77
   CO   GRAMS/MI                          20.66              .36              .32              .17
   CO2  GRAMS/MI                          740.3            724.9            615.9            697.9
   NOX  GRAMS/MI                            .94             1.24             2.02             1.67
   FUEL ECONOMY IN MPG                    11.66    12.06   12.45            14.63    13.70   12.93
   RUN TIME            SECONDS            505.              867.             505.              868.
   MEASURED DISTANCE   MI                 3.59      7.46    3.87             3.59      7.45    3.87
   SCF, DRY                               .964      .969    .971             .967      .970    .971
        DFC, WET (DRY)                         .886( .870)                        .899( .883)
        TOT VOL (SCM) / SAM BLR (SCM)          201.6/   .00                       201.5/   .00

OMPOSITE RESULTS
   TEST NUMBER         215                                                           3-BAG      (4-BAG)
   BAROMETER    MM HG  735.8                     CARBON DIOXIDE        G/MI          698.2      ( 690.2)
   HUMIDITY     G/KG    11.0                     FUEL ECONOMY          MPG           12.80      ( 12.94)
   TEMPERATURE  DEG C   24.4                     HYDROCARBONS (THC)    G/MI            .82      (   .86)
                                                 CARBON MONOXIDE       G/MI           4.55      (  4.50)
                                                 OXIDES OF NITROGEN    G/MI           1.39      (  1.52)
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TABLE C-21

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                     SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                   FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   216          RUN   1               VEHICLE NO.862                  TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS            DATE    4/ 2/90                 ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                    BAG CART NO. 2 / CVS NO.  2     GASOLINE  EM-905-F
TRANSMISSION A3                               DYNO NO.      3                 ODOMETER 132203. KM( 82147. MILES)

BAROMETER 741.66 MM HG(29.20 IN HG)           DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
RELATIVE HUMIDITY  56. PCT                    ABS. HUMIDITY 11.4 GM/KG        NOX HUMIDITY CORRECTION FACTOR  1.02
BAG RESULTS
  BAG NUMBER                                       1                2               3                 4
  DESCRIPTION                               COLD TRANSIENT     STABILIZED     HOT TRANSIENT      STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)              812.8 (32.0)     810.3 (31.9)    787.4 (31.0)     810.3 (31.9)
  BLOWER INLET P MM. H2O(IN. H2O)            812.8 (32.0)     810.3 (31.9)    787.4 (31.0)     810.3 (31.9)
  BLOWER INLET TEMP. DEG. C(DEG. F)           43.3 (110.0)     43.3 (110.0)    42.8 (109.0)     42.8 (109.0)
  BLOWER REVOLUTIONS                           40497.           69454.          40418.           69444.
  TOT FLOW STD. CU. METRES(SCF)               74.8 ( 2640.)   128.3 ( 4530.)   75.0 ( 2647.)   128.4 ( 4533.)
  THC SAMPLE METER/RANGE/PPM                11.2/   3/ 112.  45.6/   2/  45.  73.7/   2/  73.   51.9/   2/  51.
  THC BCKGRD METER/RANGE/PPM                  .8/   3/   8.   8.0/   2/   8.   7.9/   2/   8.    9.9/   2/  10.
  CO  SAMPLE METER/RANGE/PPM                65.7/   1/ 600.   7.5/  12/   7.   9.5/  12/   9.    4.0/  12/   4.
  CO  BCKGRD METER/RANGE/PPM                  .1/   1/   1.    .0/  12/   0.    .0/  12/   0.     .6/  12/   1.
  CO2 SAMPLE METER/RANGE/PCT                36.6/   2/1.9308 68.1/   1/1.2527 88.6/   1/1.6437  65.1/   1/1.1973
  CO2 BCKGRD METER/RANGE/PCT                  .8/   2/ .0408  2.3/   1/ .0406  2.4/   1/ .0423   2.4/   1/ .0423
  NOX SAMPLE METER/RANGE/PPM                28.0/   2/ 28.1  19.3/   2/ 19.4  47.0/   2/ 47.0   23.6/   2/ 23.7
  NOX BCKGRD METER/RANGE/PPM                  .0/   2/   .0    .0/   2/   .0    .1/   2/   .1     .1/   2/   .1
  DILUTION FACTOR                                6.80            10.80            8.23             11.30
  THC CONCENTRATION PPM                         105.              38.             66.               42.
  CO  CONCENTRATION PPM                         567.               7.              9.                3.
  CO2 CONCENTRATION PCT                        1.8960           1.2169          1.6065            1.1587
  NOX CONCENTRATION PPM                         28.1             19.4            46.9              23.6
  THC MASS GRAMS                                 4.50             2.79            2.84              3.12
  CO  MASS GRAMS                                49.36             1.03             .76               .47
  CO2 MASS GRAMS                               2595.7           2858.1          2205.2            2723.6
  NOX MASS GRAMS                                 4.10             4.86            6.88              5.92

  THC  GRAMS/MI                                  1.26              .73             .80               .81
  CO   GRAMS/MI                                 13.87              .27             .21               .12
  CO2  GRAMS/MI                                 729.5            747.1           623.5             707.4
  NOX  GRAMS/MI                                  1.15             1.27            1.95              1.54
  FUEL ECONOMY IN MPG                           11.99     12.04  12.08           14.46     13.52   12.75
  RUN TIME             SECONDS                  505.             867.            505.              868.
  MEASURED DISTANCE    MI                       3.56      7.38   3.83            3.54      7.39    3.85
  SCF. DRY                                      .965      .969   .971            .967      .970    .971
       DFC. WET (DRY)                                 .887( .871)                      .899( .883)
       TOT VOL (SCM) / SAM BLR (SCM)                 203.1/   .00                     203.4/   .00

COMPOSITE RESULTS                                                                            3-BAG      (4-BAG)
  TEST NUMBER        216                                  CARBON DIOXIDE      G/MI          709.6      ( 697.9)
  BAROMETER   MM HG  741.7                                FUEL ECONOMY        MPG           12.63      ( 12.84)
  HUMIDITY    G/KG    11.4                                HYDROCARBONS (THC)  G/MI            .86      (   .88)
  TEMPERATURE  DEG C  25.0                                CARBON MONOXIDE     G/MI           3.07      (  3.03)
                                                          OXIDES OF NITROGEN  G/MI           1.43      (  1.51)
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TABLE C-22

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2009-001

TEST NO.   215        RUN  2          VEHICLE NO.862                      TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS    DATE    4/ 3/90                     ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8            BAG CART NO. 2 / CVS NO.  2         GASOLINE  EM-905-F
TRANSMISSION A3                       DYNO NO.      3                     ODOMETER 132232. KM( 82165. MILES)

BAROMETER 744.47 MM HG(29.31 IN HG)   DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
RELATIVE HUMIDITY  23. PCT            ABS. HUMIDITY  4.9 GM/KG            NOX HUMIDITY CORRECTION FACTOR   .84
BAG RESULTS
  BAG NUMBER                                1                 2                 3                 4
  DESCRIPTION                         COLD TRANSIENT      STABILIZED       HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)         810.3 (31.9)      810.3 (31.9)      810.3 (31.9)      807.7 (31.8)
  BLOWER INLET P MM. H2O(IN. H2O)       810.3 (31.9)      810.3 (31.9)      810.3 (31.9)      807.7 (31.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)      42.8 (109.0)      42.8 (109.0)      42.8 (109.0)      42.2 (108.0)
  BLOWER REVOLUTIONS                      40423.            69369.            40413.            69454.
  TOT FLOW STD. CU. METRES(SCF)          75.0 ( 2650.)    128.8 ( 4547.)     75.0 ( 2649.)    129.1 ( 4559.)
  THC SAMPLE METER/RANGE/PPM          11.2/   3/ 112.    42.5/   2/  42.    78.0/   2/  77.   46.9/   2/  46.
  THC BCKGRD METER/RANGE/PPM           1.0/   3/  10.     9.3/   2/   9.     8.6/   2/   9.    8.1/   2/   8.
  CO  SAMPLE METER/RANGE/PPM          83.3/   1/ 829.     6.1/  12/   6.    12.3/  12/  12.    3.6/  12/   3.
  CO  BCKGRD METER/RANGE/PPM            .1/   1/   1.      .1/  12/   0.      .0/  12/   0.     .0/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT          37.1/   2/1.9581   66.0/   1/1.2142   87.9/   1/1.6302   63.8/   1/1.1729
  CO2 BCKGRD METER/RANGE/PCT           1.0/   2/ .0511    2.5/   1/ .0441    2.5/   1/ .0441    2.3/   1/ .0406
  NOX SAMPLE METER/RANGE/PPM          30.4/   2/ 30.4    25.1/   2/ 25.2    64.3/   2/ 64.3    32.5/   2/ 32.5
  NOX BCKGRD METER/RANGE/PPM            .0/   2/   .0      .0/   2/   .0      .0/   2/   .0     .0/   2/   .0
  DILUTION FACTOR                          6.64              11.15              8.29              11.54
  THC CONCENTRATION PPM                    103.               34.               70.                39.
  CO  CONCENTRATION PPM                    791.                6.               11.                 3.
  CO2 CONCENTRATION PCT                   1.9147            1.1741            1.5914            1.1359
  NOX CONCENTRATION PPM                    30.4              25.2              64.3              32.5
  THC MASS GRAMS                           4.44              2.49              3.00              2.89
  CO  MASS GRAMS                          69.14               .84              1.00               .50
  CO2 MASS GRAMS                         2630.9            2768.3            2186.0            2685.2
  NOX MASS GRAMS                           3.67              5.20              7.74              6.75

  THC  GRAMS/MI                            1.24               .64               .84               .75
  CO   GRAMS/MI                           19.32               .22               .28               .13
  CO2  GRAMS/MI                           735.1             715.7             609.2             694.9
  NOX  GRAMS/MI                            1.03              1.35              2.16              1.75
  FUEL ECONOMY IN MPG                     11.77     12.20   12.61             14.79     13.80   12.99
  RUN TIME            SECONDS             505.              867.              505.              868.
  MEASURED DISTANCE   MI                  3.58      7.45    3.87              3.59      7.45    3.86
  SCF. DRY                                .975      .979    .982              .978      .981    .982
      DFC. WET (DRY)                           .888( .881)                        .901( .894)
      TOT VOL (SCM) / SAM BLR (SCM)           203.8/   .00                        204.2/   .00

COMPOSITE RESULTS
  TEST NUMBER          215                                                    3-BAG      (4-BAG)
  BAROMETER    MM HG  744.5                 CARBON DIOXIDE       G/MI         690.5      ( 684.3)
  HUMIDITY     G/KG     4.9                 FUEL ECONOMY         MPG          12.95      ( 13.06)
  TEMPERATURE  DEG C   26.1                 HYDROCARBONS (THC)   G/MI           .82      (   .85)
                                            CARBON MONOXIDE      G/MI          4.18      (  4.15)
                                            OXIDES OF NITROGEN   G/MI          1.50      (  1.62)
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TABLE C-23

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                    PROJECT 08-2809-001

TEST NO.   221          RUN   1                VEHICLE NO.862                   TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS             DATE    3/14/90                  ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                     BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-906-F
TRANSMISSION A3                                DYNO NO.      3                  ODOMETER 131601. KM( 81773. MILES)

BAROMETER 733.55 MM HG(28.88 IN HG)            DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  67. PCT                     ABS. HUMIDITY 13.3 GM/KG         NOX HUMIDITY CORRECTION FACTOR  1.09
BAG RESULTS
  BAG NUMBER                                         1                 2                 3                 4
  DESCRIPTION                                 COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)               774.7 (30.5)      774.7 (30.5)      774.7 (30.5)      762.0 (30.0)
  BLOWER INLET P MM. H2O(IN. H2O)             769.6 (30.3)      769.6 (30.3)      769.6 (30.3)      762.0 (30.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)            43.9 (111.0)      43.3 (110.0)      43.3 (110.0)      43.3 (110.0)
  BLOWER REVOLUTIONS                            40557.            69629.            40461.            69601.
  TOT FLOW STD. CU. METRES(SCF)                74.4 ( 2626.)    127.8 ( 4512.)     74.2 ( 2622.)    127.9 ( 4516.)
  THC SAMPLE METER/RANGE/PPM                14.0/   3/ 140.   62.5/   2/  62.   10.0/   3/ 100.   59.2/   2/  59.
  THC BCKGRD METER/RANGE/PPM                 1.5/   3/  15.   11.5/   2/  11.    1.0/   3/  10.   13.7/   2/  14.
  CO  SAMPLE METER/RANGE/PPM                58.8/  13/ 139.    2.6/  12/   2.   27.7/  12/  27.    4.1/  12/   4.
  CO  BCKGRD METER/RANGE/PPM                  .0/  13/   0.     .0/  12/   0.     .0/  12/   0.    1.9/  12/   2.
  CO2 SAMPLE METER/RANGE/PCT                35.2/   2/1.0545  64.1/   1/1.1786  85.5/   1/1.5840  61.8/   1/1.1354
  CO2 BCKGRD METER/RANGE/PCT                 1.0/   2/ .0511   2.5/   1/ .0441   2.1/   1/ .0370   2.3/   1/ .0406
  NOX SAMPLE METER/RANGE/PPM                44.8/   2/ 44.8   20.9/   2/ 21.0   54.3/   2/ 54.3   25.7/   2/ 25.8
  NOX BCKGRD METER/RANGE/PPM                  .3/   2/    3     .3/   2/   .3     .0/   2/   .0     .0/   2/   .0
  DILUTION FACTOR                                 7.07             11.22              8.33             11.65
  THC CONCENTRATION PPM                           127.               51.               91.               46.
  CO  CONCENTRATION PPM                           131.                2.               26.                2.
  CO2 CONCENTRATION PCT                         1.8107            1.1384            1.5514            1.0984
  NOX CONCENTRATION PPM                           44.5              20.7              54.3              25.8
  THC MASS GRAMS                                  5.66              3.95              4.06              3.55
  CO  MASS GRAMS                                 11.33               .35              2.21               .32
  CO2 MASS GRAMS                                2465.2            2663.3            2108.9            2571.9
  NOX MASS GRAMS                                  6.93              5.53              8.43              6.89

  THC  GRAMS/MI                                   1.58              1.02              1.13               .92
  CO   GRAMS/MI                                   3.17               .09               .62               .08
  CO2  GRAMS/MI                                  689.8             689.7             589.7             667.8
  NOX  GRAMS/MI                                   1.94              1.43              2.36              1.79
  FUEL ECONOMY IN MPG                            12.15     12.21   12.26             14.30     13.41   12.67
  RUN TIME           SECONDS                     505.              868.              505.              868.
  MEASURED DISTANCE    MI                        3.57      7.44    3.86              3.58      7.43    3.85
  SCF. DRY                                       .961      .965    .967              .963      .966    .967
      DFC. WET (DRY)                                  .892( .872)                        .902( .882)
      TOT VOL (SCM) / SAM BLR (SCM)                   202.1/   .00                       202.1/   .00

COMPOSITE RESULTS                                                                          3-BAG       (4-BAG)
  TEST NUMBER          221                                 CARBON DIOXIDE       G/MI       662.3       ( 655.8)
  BAROMETER    MM HG  733.6                                FUEL ECONOMY         MPG        12.74       ( 12.86)
  HUMIDITY     G/KG    13.3                                HYDROCARBONS (THC)   G/MI        1.17       (  1.14)
  TEMPERATURE  DEG C   24.4                                CARBON MONOXIDE      G/MI         .87       (   .87)
                                                           OXIDES OF NITROGEN   G/MI        1.79       (  1.90)
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TABLE C-24

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                         FTP   - VEHICLE EMISSIONS RESULTS -
                                PROJECT 08-2809-001

TEST NO.   222         RUN   1              VEHICLE NO.862                  TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS          DATE    3/15/90                 ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                  BAG CART NO. 2 / CVS NO.  2     GASOLINE  EM-906-F
TRANSMISSION A3                             DYNO NO.      3                 ODOMETER 131635. KM( 81794. MILES)

BAROMETER 737.87 MM HG(29.05 IN HG)         DRY BULB TEMP. 23.9 DEG C(75.0 DEG F)
RELATIVE HUMIDITY  44. PCT                  ABS. HUMIDITY  8.5 GM/KG        NOX HUMIDITY CORRECTION FACTOR   .93
BAG RESULTS
  BAG NUMBER                                     1                2                 3                 4
  DESCRIPTION                              COLD TRANSIENT     STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             774.7 (30.5)      774.7 (30.5)      774.7 (30.5)      774.7 (30.5)
  BLOWER INLET P MM. H2O(IN. H2O)           769.6 (30.3)      769.6 (30.3)      769.6 (30.3)      769.6 (30.3)
  BLOWER INLET TEMP. DEG. C(DEG. F)          42.8 (109.0)      42.8 (109.0)      42.8 (109.0)      42.8 (109.0)
  BLOWER REVOLUTIONS                          40568.            69599.            40478.            69595.
  TOT FLOW STD. CU. METRES(SCF)              75.0 ( 2649.)    129.7 ( 4544.)     74.8 ( 2643.)    128.7 ( 4544.)
  THC SAMPLE METER/RANGE/PPM              13.3/   3/ 133.   50.6/   2/  50.    9.5/   3/  95.   49.9/   2/  49.
  THC BCKGRD METER/RANGE/PPM               1.0/   3/  10.    9.9/   2/  10.     .9/   3/   9.   10.8/   2/  11.
  CO  SAMPLE METER/RANGE/PPM              72.6/  13/ 175.    3.0/  12/   3.   36.4/  12/  36.    4.9/  12/   5.
  CO  BCKGRD METER/RANGE/PPM                .3/  13/   1.     .6/  12/   1.     .0/  12/   0.    2.8/  12/   3.
  CO2 SAMPLE METER/RANGE/PCT              34.1/   2/1.7947  63.6/   1/1.1692  85.2/   1/1.5782  62.2/   1/1.1429
  CO2 BCKGRD METER/RANGE/PCT                .9/   2/ .0460   2.4/   1/ .0423   2.4/   1/ .0423   2.5/   1/ .0441
  NOX SAMPLE METER/RANGE/PPM              56.5/   2/ 56.5   26.2/   2/ 26.3   61.3/   2/ 61.3   29.9/   2/ 29.9
  NOX BCKGRD METER/RANGE/PPM                .0/   2/   .0     .0/   2/   .0     .1/   2/   .1     .1/   2/   .1
  DILUTION FACTOR                              7.29             11.32              8.36             11.58
  THC CONCENTRATION PPM                        124.              41.               87.               40.
  CO  CONCENTRATION PPM                        165.               2.               34.                2.
  CO2 CONCENTRATION PCT                       1.7551            1.1306            1.5410            1.1026
  NOX COMCENTRATION PPM                        56.5              26.3              61.2              29.9
  THC MASS GRAMS                               5.59              3.18              3.90              3.06
  CO  MASS GRAMS                              14.44               .34              2.97               .32
  CO2 MASS GRAMS                             2410.5            2663.8            2111.4            2597.7
  NOX MASS GRAMS                               7.54              6.02              8.15              6.84

  THC  GRAMS/MI                                1.56               .83              1.09               .79
  CO   GRAMS/MI                                4.03               .09               .83               .08
  CO2  GRAMS/MI                               673.1             691.2             590.2             668.7
  NOX  GRAMS/MI                                2.11              1.56              2.28              1.76
  FUEL ECONOMY IN MPG                         12.42     12.33   12.25             14.29     13.39   12.66
  RUN TIME             SECONDS                505.              868.              505.              868.
  MEASURED DISTANCE    MI                     3.58      7.43    3.85              3.58      7.46    3.88
  SCF, DRY                                    .968      .972    .974              .970      .973    .975
       DFC, WET (DRY)                              .894( .881)                         .901( .888)
       TOT VOL (SCM) / SAM BLR (SCM)               203.7/  .00                         203.5/  .00

COMPOSITE RESULTS
  TEST NUMBER         222                                                               3-BAG      (4-BAG)
  BAROMETER    MM HG  737.9                           CARBON DIOXIDE       G/MI         659.7     ( 653.2)
  HUMIDITY     G/KG     8.5                           FUEL ECONOMY         MPG          12.78     ( 12.91)
  TEMPERATURE  DEG C   23.9                           HYDROCARBONS (THC)   G/MI          1.05     (  1.04)
                                                      CARBON MONOXIDE      G/MI          1.11     (  1.11)
                                                      OXIDES OF NITROGEN   G/MI          1.87     (  1.93)
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TABLE C-25

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH-
                                FTP    - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   223          RUN   1             VEHICLE NO.862                        TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS          DATE     3/16/80                      ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                  BAG CART NO. 2 / CVS NO.  2           GASOLINE  EM-906-F
TRANSMISSION A3                             DYNO NO.       3                      ODOMETER 131667. KM( 81814. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)         DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  35. PCT                  ABS. HUMIDITY  6.9 GM/KG              NOX HUMIDITY CORRECTION FACTOR   .89
BAG RESULTS
  BAG NUMBER                                     1               2                3                4
  DESCRIPTION                              COLD TRANSIENT    STABILIZED     HOT TRANSIENT     STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             764.5 (30.1)    764.5 (30.1)     767.1 (30.2)     767.1 (30.2)
  BLOWER INLET P MM. H2O(IN. H2O)           762.0 (30.0)    762.0 (30.0)     764.5 (30.1)     764.5 (30.1)
  BLOWER INLET TEMP. DEG. C(DEG. F)          44.4 (112.0)    44.4 (112.0)     44.4 (112.0)     44.4 (112.0)
  BLOWER REVOLUTIONS                          40496.          69465.           40449.           69469.
  TOT FLOW STD. CU. METRES(SCF)              75.2 ( 2654.)  128.9 ( 4553.)    75.0 ( 2649.)   128.9 ( 4550.)
  THC SAMPLE METER/RANGE/PPM               11.9/  3/ 119.   48.1/  2/  48.   87.6/  2/  87.   50.4/  2/  50.
  THC BCKGRD METER/RANGE/PPM                 .8/  3/   8.    8.0/  2/   8.    7.4/  2/   7.    8.5/  2/   8.
  CO  SAMPLE METER/RANGE/PPM               56.0/ 14/ 253.    2.9/ 12/   3.   30.2/ 12/  29.    3.4/ 12/   3.
  CO  BCKGRD METER/RANGE/PPM                 .3/ 14/   1.     .9/ 12/   1.     .9/ 12/   1.    1.0/ 12/   1.
  CO2 SAMPLE METER/RANGE/PCT               35.0/  2/1.8437  63.0/  1/1.1579  85.2/  1/1.5782  62.2/  1/1.1429
  CO2 BCKGRD METER/RANGE/PCT                 .8/  2/ .0408   2.3/  1/ .0406   2.5/  1/ .0441   2.3/  1/ .0406
  NOX SAMPLE METER/RANGE/PPM               53.4/  2/ 53.4   25.4/  2/ 25.5   61.3/  2/ 61.3   31.0/  2/ 31.0
  NOX BCKGRD METER/RANGE/PPM                 .0/  2/   .0     .0/  2/   .0     .0/  2/   .0     .0/  2/   .0
  DILUTION FACTOR                               7.07            11.43             8.36            11.58
  THC CONCENTRATION PPM                         112.             40.              80.              42.
  CO  CONCENTRATION PPM                         240.              2.              27.               2.
  CO2 CONCENTRATION PCT                        1.8086           1.1209           1.5394           1.1059
  NOX CONCENTRATION PPM                         53.4             25.5             61.3             31.0
  THC MASS GRAMS                                5.05             3.13             3.62             3.27
  CO  MASS GRAMS                               21.00              .28             2.40              .34
  CO2 MASS GRAMS                              2488.4           2646.1           2114.6           2609.0
  NOX MASS GRAMS                                6.81             5.58             7.81             6.80

  THC  GRAMS/MI                                 1.42              .82             1.02              .84
  CO   GRAMS/MI                                 5.89              .07              .68              .09
  CO2  GRAMS/MI                                698.4            694.4            595.8            672.6
  NOX  GRAMS/MI                                 1.91             1.46             2.20             1.75
  FUEL ECONOMY IN MPG                          11.93     12.06   12.19            14.16    13.29   12.58
  RUN TIME               SECONDS               505.              867.             505.             867.
  MEASURED DISTANCE      MI                     3.56      7.37    3.81             3.55     7.43    3.88
  SCF, DRY                                      .971      .975    .977             .973     .976    .978
      DFC, WET (DRY)                                  .893( .883)                         .901( .891)
      TOT VOL (SCM) / SAM BLR (SCM)                   204.1/  .00                         203.9/  .00

COMPOSITE RESULTS                                                                        3-BAG      (4-BA
  TEST NUMBER        223                                   CARBON DIOXIDE       G/MI     668.2      ( 661.
  BAROMETER    MM HG  741.4                                FUEL ECONOMY         MPG      12.62      ( 12.7
  HUMIDITY     G/KG     6.9                                HYDROCARBONS (THC)   G/MI      1.00      (  1.0
  TEMPERATURE  DEG C   24.4                                CARBON MONOXIDE      G/MI      1.45      (  1.4
                                                           OXIDES OF NITROGEN   G/MI      1.76      (  1.8
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TABLE C-26

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   231          RUN   1              VEHICLE NO.862                        TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS           DATE    3/20/90                       ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                   BAG CART NO. 2 / CVS NO.  2           GASOLINE  EM-907-F
TRANSMISSION A3                              DYNO NO.      3                       ODOMETER 131802. KM( 81898. MILES)

BAROMETER 752.35 MM HG(29.62 IN HG)          DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  17. PCT                   ABS. HUMIDITY  3.2 GM/KG              NOX HUMIDITY CORRECTION FACTOR   .80
BAG RESULTS
  BAG NUMBER                                      1                  2                  3                   4
  DESCRIPTION                              COLD TRANSIENT       STABILIZED        HOT TRANSIENT         STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             810.3 (31.9)       810.3 (31.9)       810.3 (31.9)        810.3 (31.9)
  BLOWER INLET P MM. H2O(IN. H2O)           810.3 (31.9)       807.7 (31.8)       810.3 (31.9)        807.7 (31.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)          43.3 (110.0)       43.3 (110.0)       42.8 (109.0)        42.8 (109.0)
  BLOWER REVOLUTIONS                          40447.             69382.             40390.              69358.
  TOT FLOW STD. CU. METRES(SCF)              75.9 ( 2680.)     130.2 ( 4599.)      75.9 ( 2679.)      130.3 ( 4602.)
  THC SAMPLE METER/RANGE/PPM              11.9/   3/ 119.    47.8/   2/  47.    83.9/   2/  83.     59.6/   2/  59.
  THC BCKGRD METER/RANGE/PPM                .8/   3/   8.     6.9/   2/   7.     6.8/   2/   7.      8.2/   2/   8.
  CO  SAMPLE METER/RANGE/PPM              44.1/  13/ 103.     3.0/  12/   3.     8.5/  12/   8.      3.2/  12/   3.
  CO  BCKGRD METER/RANGE/PPM                .1/  13/   0.      .0/  12/   0.      .0/  12/   0.       .0/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT              34.1/   2/1.7947   62.7/   1/1.1523   84.3/   1/1.5609    62.1/   1/1.1411
  CO2 BCKGRD METER/RANGE/PCT                .9/   2/ .0460    2.4/   1/ .0423    2.6/   1/ .0459     3.0/   1/ .0530
  NOX SAMPLE METER/RANGE/PPM              60.3/   2/ 60.3    26.3/   2/ 28.4    60.3/   2/ 60.3     27.9/   2/ 28.0
  NOX BCKGRD METER/RANGE/PPM                .0/   2/   .0     .0/   2/   .0     .0/   2/   .0      .0/   2/   .0
  DILUTION FACTOR                              7.25               11.37               8.38               11.47
  THC CONCENTRATION PPM                        112.               41.                 77.                52.
  CO  CONCENTRATION PPM                        98.                3.                  8.                 3.
  CO2 CONCENTRATION PCT                        1.7551             1.1137              1.5205             1.0927
  NOX CONCENTRATION PPM                        60.3               28.4                60.3               28.0
  THC MASS GRAMS                               5.09               3.21                3.51               4.03
  CO  MASS GRAMS                               8.67                .42                 .69                .45
  CO2 MASS GRAMS                               2439.2             2655.6              2112.1             2607.2
  NOX MASS GRAMS                               7.02               5.67                7.02               5.59

  THC  GRAMS/MI                                1.41                .83                 .98               1.04
  CO   GRAMS/MI                                2.41                .11                 .19                .12
  CO2  GRAMS/MI                                677.7              688.4               591.5              670.4
  NOX  GRAMS/MI                                1.95               1.47                1.97               1.44
  FUEL ECONOMY IN MPG                          12.36     12.31    12.27               14.25     13.33    12.58
  RUN TIME              SECONDS                505.               867.                505.               867.
  MEASURED DISTANCE     MI                     3.60      7.46     3.86                3.57      7.46     3.89
  SCF, DRY                                     .977      .981     .983                .979      .982     .983
       DFC, WET (DRY)                                .894( .889)                            .901( .896)
       TOT VOL (SCM) / SAM BLR (SCM)                206.1/   .00                           206.2/   .00

COMPOSITE RESULTS                                                                               3-BAG      (4-BAG)
  TEST NUMBER          231                                   CARBON DIOXIDE         G/MI       659.6     ( 654.4)
  BAROMETER    MM HG  752.3                                  FUEL ECONOMY           MPG        12.77     ( 12.87)
  HUMIDITY     G/KG     3.2                                  HYDROCARBONS (THC)     G/MI         .99     (  1.05)
  TEMPERATURE  DEG C   24.4                                  CARBON MONOXIDE        G/MI         .61     (   .61)
                                                             OXIDES OF NITROGEN     G/MI        1.70     (  1.69)
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TABLE C-27

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                       SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                     FTP   - VEHICLE EMISSIONS RESULTS -
                                          PROJECT 08-2809-001

TEST NO.   232          RUN   2                 VEHICLE NO.862                   TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS              DATE    3/23/90                  ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                      BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-907-F
TRANSMISSION A3                                 DYNO NO.      3                  ODOMETER 131892. KM( 81954. MILES)

BAROMETER 743.97 MM HG(29.29 IN HG)             DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
RELATIVE HUMIDITY  56. PCT                      ABS. HUMIDITY 11.4 GM/KG         NOX HUMIDITY CORRECTION FACTOR  1.02
BAG RESULTS
   BAG NUMBER                                        1               2                3                 4
   DESCRIPTION                                COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)               800.1 (31.5)     800.1 (31.5)     774.7 (30.5)      800.1 (31.5)
   BLOWER INLET P MM. H2O(IN. H2O)             795.0 (31.3)     795.0 (31.3)     772.2 (30.4)      795.0 (31.3)
   BLOWER INLET TEMP. DEG. C(DEG. F)            45.0 (113.0)     45.6 (114.0)     44.4 (112.0)      44.4 (112.0)
   BLOWER REVOLUTIONS                             40407.           69302.           40385.            69389.
   TOT FLOW STD. CU. METRES(SCF)                74.9 ( 2646.)   128.7 ( 4543.)    75.1 ( 2652.)    128.6 ( 4541.)
   THC SAMPLE METER/RANGE/PPM                13.6/  3/ 136.   61.0/  2/  60.   10.7/  3/ 107.    66.4/  2/  66.
   THC BCKGRD METER/RANGE/PPM                 1.1/  3/  11.    9.3/  2/   9.     .8/  3/   8.     9.2/  2/   9.
   CO  SAMPLE METER/RANGE/PPM                83.3/ 12/  83.    2.9/ 12/   3.   10.4/ 12/  10.     3.1/ 12/   3.
   CO  BCKGRD METER/RANGE/PPM                  .1/ 12/   0.     .0/ 12/   0.     .2/ 12/   0.      .6/ 12/   1.
   CO2 SAMPLE METER/RANGE/PCT                35.4/  2/1.8654  64.4/  1/1.1842  86.8/  1/1.6090   63.4/  1/1.1654
   CO2 BCKGRD METER/RANGE/PCT                 1.0/  2/ .0511   2.5/  1/ .0441   2.2/  1/ .0388    2.3/  1/ .0406
   NOX SAMPLE METER/RANGE/PPM                48.6/  2/ 48.6   22.1/  2/ 22.2   51.5/  2/ 51.5    25.3/  2/ 25.4
   NOX BCKGRD METER/RANGE/PPM                  .0/  2/   .0     .1/  2/   .1     .1/  2/   .1      .1/  2/   .1
   DILUTION FACTOR                                6.98             11.06            8.12              11.23
   THC CONCENTRATION PPM                          126.              52.             100.               57.
   CO  CONCENTRATION PPM                           79.               3.               9.                2.
   CO2 CONCENTRATION PCT                        1.8217            1.1441          1.5750            1.1285
   NOX CONCENTRATION PPM                          48.6              22.1            51.4              25.3
   THC MASS GRAMS                                 5.67              4.01            4.49              4.43
   CO  MASS GRAMS                                 6.85               .40             .82               .35
   CO2 MASS GRAMS                               2499.6            2695.0          2165.7            2657.2
   NOX MASS GRAMS                                 7.12              5.55            7.54              6.35

   THC  GRAMS/MI                                  1.58              1.04            1.25              1.15
   CO   GRAMS/MI                                  1.91               .10             .23               .09
   CO2  GRAMS/MI                                 696.9             697.0           603.2             692.1
   NOX  GRAMS/MI                                  1.98              1.43            2.10              1.65
   FUEL ECONOMY IN MPG                           12.03     12.07    12.10           13.96    12.98    12.18
   RUN TIME            SECONDS                   505.               867.            505.              868.
   MEASURED DISTANCE   MI                        3.59      7.45     3.87            3.59     7.43     3.84
   SCF, DRY                                      .963      .968     .970            .966     .969     .970
        DFC, WET (DRY)                                .890( .874)                        .898( .882)
        TOT VOL (SCM) / SAM BLR (SCM)                 203.6/  .00                        203.7/  .00

COMPOSITE RESULTS                                                                         3-BAG       (4-BAG)
   TEST NUMBER        232                                 CARBON DIOXIDE        G/MI      671.2       ( 669.7)
   BAROMETER    MM HG  744.0                              FUEL ECONOMY          MPG       12.54       ( 12.57)
   HUMIDITY     G/KG    11.4                              HYDROCARBONS (THC)    G/MI       1.21       (  1.24)
   TEMPERATURE  DEG C   25.0                              CARBON MONOXIDE       G/MI        .51       (   .51)
                                                          OXIDES OF NITROGEN    G/MI       1.73       (  1.80)
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TABLE C-28
SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 233 RUN 1	VEHICLE NO.862	TEST WEIGHT 2041. KG(4500. LBS)
VEHICLE MODEL 77 MERCURY MARQUIS	DATE 3/22/90	ACTUAL ROAD LOAD 10.4 KW(14.0 HP)
ENGINE 5.7 L(351. CID) V-8	BAG CART NO. 2 / CVS NO. 2	GASOLINE EM-907-F
TRANSMISSION A3	DYNO NO. 3	ODOMETER 131860. KM(81934. MILES)

BAROMETER 742.44 MM HG(29.23 IN HG)	DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)	
RELATIVE HUMIDITY 49. PCT	ABS. HUMIDITY 9.9 GM/KG	NOX HUMIDITY CORRECTION FACTOR .98

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	810.3 (31.9)		810.3 (31.9)	810.3 (31.9)		800.1 (31.5)
BLOWER INLET P MM. H2O(IN. H2O)	807.7 (31.8)		807.7 (31.8)	807.7 (31.8)		792.5 (31.2)
BLOWER INLET TEMP. DEG. C(DEG. F)	43.3 (110.0)		43.3 (110.0)	43.3 (110.0)		43.3 (110.0)
BLOWER REVOLUTIONS	40428.		69350.	40422.		69428.
TOT FLOW STD. CU. METRES(SCF)	74.8 (2640.)		128.2 (4528.)	74.8 (2640.)		128.7 (4544.)
THC SAMPLE METER/RANGE/PPM	13.6/ 3/ 136.		58.5/ 2/ 58.	89.5/ 2/ 89.		69.3/ 2/ 69.
THC BCKGRD METER/RANGE/PPM	1.0/ 3/ 10.		9.5/ 2/ 9.	9.3/ 2/ 9.		8.1/ 2/ 8.
CO SAMPLE METER/RANGE/PPM	56.0/ 13/ 132.		4.3/ 12/ 4.	9.0/ 12/ 9.		3.9/ 12/ 4.
CO BCKGRD METER/RANGE/PPM	.3/ 13/ 1.		.0/ 12/ 0.	.4/ 12/ 0.		.0/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	35.3/ 2/1.8600		64.6/ 1/1.1879	88.2/ 1/1.6360		62.9/ 1/1.1561
CO2 BCKGRD METER/RANGE/PCT	1.0/ 2/ .0511		2.6/ 1/ .0459	2.6/ 1/ .0459		2.4/ 1/ .0423
NOX SAMPLE METER/RANGE/PPM	50.6/ 2/ 50.6		22.9/ 2/ 23.0	53.0/ 2/ 53.0		23.8/ 2/ 23.9
NOX BCKGRD METER/RANGE/PPM	.1/ 2/ .1		.0/ 2/ .0	.0/ 2/ .0		.0/ 2/ .0
DILUTION FACTOR	6.98		11.02	8.00		11.31
THC CONCENTRATION PPM	127.		49.	81.		61.
CO CONCENTRATION PPM	124.		4.	8.		4.
CO2 CONCENTRATION PCT	1.8162		1.1462	1.5959		1.1175
NOX CONCENTRATION PPM	50 5		23.0	53.0		23.9
THC MASS GRAMS	5.70		3.80	3.61		4.73
CO MASS GRAMS	10.82		.59	.69		.54
CO2 MASS GRAMS	2486.5		2691.2	2184.4		2632.6
NOX MASS GRAMS	7.05		5.49	7.39		5.73
THC GRAMS/MI	1.58		.98	1.00		1.22
CO GRAMS/MI	3.01		.15	.19		.14
CO2 GRAMS/MI	691.0		696.8	607.9		680.2
NOX GRAMS/MI	1.96		1.42	2.06		1.48
FUEL ECONOMY IN MPG	12.10	12.10	12.11	13.87	13.06	12.39
RUN TIME SECONDS	505.		970.	505.		868.
MEASURED DISTANCE MI	3.60	7.46	3.86	3.59	7.46	3.87
SCF. DRY	.966	.970	.972	.968	.971	.973
DFC. WET (DRY)		.890(.876)			.898(.884)	
TOT VOL (SCM) / SAM BLR (SCM)		203.0/ .00			203.4/ .00	

COMPOSITE RESULTS

TEST NUMBER		233
BAROMETER	MM HG	742.4
HUMIDITY	G/KG	9.9
TEMPERATURE	DEG C	25.0

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	671.2	(666.3)
FUEL ECONOMY	MPG	12.54	(12.63)
HYDROCARBONS (THC)	G/MI	1.11	(1.18)
CARBON MONOXIDE	G/MI	.76	(.75)
OXIDES OF NITROGEN	G/MI	1.71	(1.72)

TABLE C-29

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                  FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   241          RUN   1             VEHICLE NO.862                      TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS          DATE    3/27/90                     ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                  BAG CART NO. 2 / CVS NO.  2         GASOLINE  EM-908-F
TRANSMISSION A3                             DYNO NO.      3                     ODOMETER 132029. KM( 82039. MILES)

BAROMETER 745.74 MM HG(29.36 IN HG)         DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  40. PCT                  ABS. HUMIDITY  7.3 GM/KG            NOX HUMIDITY CORRECTION FACTOR   .90
BAG RESULTS
   BAG NUMBER                                    1                2                3                4
   DESCRIPTION                             COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)            810.3 (31.9)     812.8 (32.0)     810.3 (31.9)     810.3 (31.9)
   BLOWER INLET P MM. H2O(IN. H2O)          807.7 (31.8)     810.3 (31.9)     807.7 (31.8)     807.7 (31.8)
   BLOWER INLET TEMP. DEG. C(DEG. F)         42.8 (109.0)     42.8 (109.0)     42.8 (109.0)     42.8 (109.0)
   BLOWER REVOLUTIONS                         40417.           69393.           40350.           69414.
   TOT FLOW STD. CU. METRES(SCF)             75.2 ( 2655.)   129.1 ( 4557.)    75.1 ( 2651.)   129.2 ( 4560.)
   THC SAMPLE METER/RANGE/PPM              13.0/   3/ 130.  57.4/   2/  57.    9.8/   3/  98.  67.7/   2/  67.
   THC BCKGRD METER/RANGE/PPM                .9/   3/   9.   9.0/   2/   9.    1.0/   3/  10.   8.5/   2/   8.
   CO  SAMPLE METER/RANGE/PPM              56.8/  13/ 134.   4.0/  12/   4.    9.2/  12/   9.   6.1/  12/   6.
   CO  BCKGRD METER/RANGE/PPM                .3/  13/   1.    .5/  12/   0.     .6/  12/   1.   2.9/  12/   3.
   CO2 SAMPLE METER/RANGE/PCT              35.0/   2/1.8437 64.6/   1/1.1879  87.0/   1/1.6128 63.4/   1/1.1654
   CO2 BCKGRD METER/RANGE/PCT                .9/   2/ .0460  2.6/   1/ .0459   2.6/   1/ .0459  2.6/   1/ .0459
   NOX SAMPLE METER/RANGE/PPM              51.1/   2/ 51.1  23.4/   2/ 23.5   52.3/   2/ 52.3  24.5/   2/ 24.6
   NOX BCKGRD METER/RANGE/PPM                .0/   2/   .0    .0/   2/   .0    .1/   2/   .1    .0/   2/   .0
   DILUTION FACTOR                               7.06            11.06             8.13            11.26
   THC CONCENTRATION PPM                         122.             49.              89.              59.
   CO  CONCENTRATION PPM                         127.              3.               8.               3.
   CO2 CONCENTRATION PCT                        1.8042           1.1462           1.5726           1.1236
   NOX CONCENTRATION PPM                         51.1             23.5             52.2             24.6
   THC MASS GRAMS                                5.49             3.77             4.00             4.59
   CO  MASS GRAMS                               11.09              .49              .69              .47
   CO2 MASS GRAMS                              2484.1           2708.4           2161.5           2656.9
   NOX MASS GRAMS                                6.60             5.21             6.74             5.45

   THC  GRAMS/MI                                 1.54              .98             1.12             1.20
   CO   GRAMS/MI                                 3.11              .13              .19              .12
   CO2  GRAMS/MI                                696.5            703.5            606.4            696.0
   NOX  GRAMS/MI                                 1.85             1.35             1.89             1.43
   FUEL ECONOMY IN MPG                          11.99     11.98  11.98            13.87    12.89  12.09
   RUN TIME             SECONDS                 505.             868.             505.             867.
   MEASURED DISTANCE    MI                      3.57      7.42   3.85             3.56     7.38   3.82
   SCF, DRY                                     .969      .973   .975             .971     .974   .976
        DFC, WET (DRY)                              .891( .879)                       .899( .887)
        TOT VOL (SCM) / SAM BLR (SCM)              204.3/   .00                      204.2/   .00

COMPOSITE RESULTS                                                                      3-BAG       (4-BAG)
   TEST NUMBER        241                        CARBON DIOXIDE        G/MI           675.4       ( 673.1)
   BAROMETER    MM HG  745.7                     FUEL ECONOMY          MPG            12.44       ( 12.48)
   HUMIDITY     G/KG     7.3                     HYDROCARBONS (THC)    G/MI            1.13       (  1.20)
   TEMPERATURE  DEG C   23.3                     CARBON MONOXIDE       G/MI             .76       (   .76)
                                                 OXIDES OF NITROGEN    G/MI            1.60       (  1.63)
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TABLE C-30

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          SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                         FTP   - VEHICLE EMISSIONS RESULTS -
                                 PROJECT 08-2809-001

TEST NO.   242          RUN   1          VEHICLE NO.862                   TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS       DATE    3/28/90                  ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8               BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-908-F
TRANSMISSION A3                          DYNO NO.      3                  ODOMETER 132060. KM( 82058. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)      DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
RELATIVE HUMIDITY  50. PCT               ABS. HUMIDITY 11.0 GM/KG          NOX HUMIDITY CORRECTION FACTOR  1.01
BAG RESULTS
  BAG NUMBER                                    1                 2                 3                 4
  DESCRIPTION                            COLD TRANSIENT       STABILIZED       HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)           810.3 (31.9)      810.3 (31.9)      810.3 (31.9)      810.3 (31.9)
  BLOWER INLET P MM. H2O(IN. H2O)         807.7 (31.8)      807.7 (31.8)      807.7 (31.8)      807.7 (31.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)        42.8 (109.0)      43.3 (110.0)      43.3 (110.0)      43.3 (110.0)
  BLOWER REVOLUTIONS                        40428.            69378.            40390.            69507.
  TOT FLOW STD. CU. METRES(SCF)            74.4 ( 2628.)    127.6 ( 4505.)     74.3 ( 2623.)    127.8 ( 4514.)
  THC SAMPLE METER/RANGE/PPM             14.8/   3/ 148.   64.1/   2/  63.    9.9/   3/  99.   95.0/   2/  94.
  THC BCKGRD METER/RANGE/PPM              1.3/   3/  13.   12.6/   2/  12.    1.2/   3/  12.   12.5/   2/  12.
  CO  SAMPLE METER/RANGE/PPM             62.8/  13/ 149.    4.2/  12/   4.    9.9/  12/  10.    2.9/  12/   3.
  CO  BCKGRD METER/RANGE/PPM               .5/  13/   1.     .6/  12/   1.     .5/  12/   0.     .1/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT             35.3/   2/1.8600  65.9/   1/1.2123  88.6/   1/1.6437  64.8/   1/1.1917
  CO2 BCKGRD METER/RANGE/PCT              1.0/   2/ .0511   2.7/   1/ .0476   2.7/   1/ .0476   2.8/   1/ .0494
  NOX SAMPLE METER/RANGE/PPM             44.6/   2/ 44.6   20.6/   2/ 20.7   48.3/   2/ 48.3   23.6/   2/ 23.7
  NOX BCKGRD METER/RANGE/PPM               .0/   2/   .0     .0/   2/   .0     .0/   2/   .0     .0/   2/   .0
  DILUTION FACTOR                             6.99             10.83              7.98             10.99
  THC CONCENTRATION PPM                       136.               52.               88.               83.
  CO  CONCENTRATION PPM                       140.                3.                9.                3.
  CO2 CONCENTRATION PCT                     1.8162            1.1691            1.6021            1.1468
  NOX CONCENTRATION PPM                       44.6              20.7              48.3              23.7
  THC MASS GRAMS                              6.09              3.98              3.93              6.34
  CO  MASS GRAMS                             12.15               .50               .75               .38
  CO2 MASS GRAMS                            2474.7            2730.8            2178.5            2683.8
  NOX MASS GRAMS                              6.40              5.09              6.92              5.83

  THC  GRAMS/MI                               1.72              1.05              1.11              1.66
  CO   GRAMS/MI                               3.43               .13               .21               .10
  CO2  GRAMS/MI                              697.6             716.8             614.1             702.7
  NOX  GRAMS/MI                               1.81              1.33              1.95              1.53
  FUEL ECONOMY IN MPG                        11.95     11.85    11.75             13.70     12.74   11.96
  RUN TIME                 SECONDS           505.               867.              505.              868.
  MEASURED DISTANCE        MI                3.55      7.36     3.81              3.55      7.37    3.82
  SCF, DRY                                   .966      .970     .972              .968      .970    .972
      DFC, WET (DRY)                              .889( .875)                          .896( .882)
      TOT VOL (SCM) / SAM BLR (SCM)              202.0/   .00                          202.1/   .00

MPOSITE RESULTS
  TEST NUMBER          242                                                          3-BAG      (4-BAG)
  BAROMETER    MM HG   738.6                     CARBON DIOXIDE      G/MI          684.6      ( 680.4)
  HUMIDITY     G/KG     11.0                     FUEL ECONOMY        MPG           12.27      ( 12.34)
  TEMPERATURE  DEG C    26.1                     HYDROCARBONS (THC)  G/MI           1.20      (  1.38)
                                                 CARBON MONOXIDE     G/MI            .84      (   .83)
                                                 OXIDES OF NITROGEN  G/MI           1.60      (  1.66)
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TABLE C-31

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                      SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                      FTP   - VEHICLE EMISSIONS RESULTS -
                                            PROJECT 08-2809-001

TEST NO.   243          RUN   1             VEHICLE NO.862                     TEST WEIGHT  2041. KG( 4500. LBS)
VEHICLE MODEL   77 MERCURY MARQUIS          DATE    3/29/90                    ACTUAL ROAD LOAD  10.4 KW( 14.0 HP)
ENGINE 5.7 L(351. CID) V-8                  BAG CART NO. 2 / CVS NO.  2        GASOLINE  EM-908-F
TRANSMISSION A3                             DYNO NO.      3                    ODOMETER 132089. KM( 82076. MILES)

BAROMETER 735.84 MM HG(28.97 IN HG)         DRY BULB TEMP. 26.1 DEG C(79.0 DEG F)
RELATIVE HUMIDITY  50. PCT                  ABS. HUMIDITY 11.0 GM/KG           NOX HUMIDITY CORRECTION FACTOR  1.01
BAG RESULTS
  BAG NUMBER                                     1                  2                 3                  4
  DESCRIPTION                              COLD TRANSIENT      STABILIZED       HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             810.3 (31.9)       807.7 (31.8)      807.7 (31.8)       792.5 (31.2)
  BLOWER INLET P MM. H2O(IN. H2O)           807.7 (31.8)       805.2 (31.7)      805.2 (31.7)       789.9 (31.1)
  BLOWER INLET TEMP. DEG. C(DEG. F)          43.9 (111.0)       43.3 (110.0)      43.3 (110.0)       42.8 (109.0)
  BLOWER REVOLUTIONS                          40581.             69574.            40461.             69437.
  TOT FLOW STD. CU. METRES(SCF)              74.3 ( 2622.)     127.5 ( 4501.)     74.1 ( 2617.)     127.6 ( 4506.)
  THC SAMPLE METER/RANGE/PPM              14.4/   3/ 144.    62.2/   2/  62.     9.7/   3/  97.    67.7/   2/  67.
  THC BCKGRD METER/RANGE/PPM               1.5/   3/  15.    14.4/   2/  14.     1.6/   3/  16.     9.7/   2/  10.
  CO  SAMPLE METER/RANGE/PPM              53.5/  13/ 126.     4.1/  12/   4.    10.3/  12/  10.     3.2/  12/   3.
  CO  BCKGRD METER/RANGE/PPM                .5/  13/   1.     1.0/  12/   1.      .6/  12/   1.      .9/  12/   1.
  CO2 SAMPLE METER/RANGE/PCT              34.9/   2/1.8382   64.9/   1/1.1936   87.5/   1/1.6225   63.7/   1/1.1711
  CO2 BCKGRD METER/RANGE/PCT               1.0/   2/ .0511    2.8/   1/ .0494    2.9/   1/ .0512    2.5/   1/ .0441
  NOX SAMPLE METER/RANGE/PPM              43.3/   2/ 43.3    20.4/   2/ 20.5    46.3/   2/ 46.3    21.8/   2/ 21.9
  NOX BCKGRD METER/RANGE/PPM                .0/   2/   .0      .1/   2/   .1      .5/   2/   .5      .1/   2/   .1
  DILUTION FACTOR                              7.08               11.00              8.08              11.21
  THC CONCENTRATION PPM                        131.                49.                83.                58.
  CO  CONCENTRATION PPM                        118.                 3.                 9.                 2.
  CO2 CONCENTRATION PCT                      1.7944             1.1486             1.5776             1.1309
  NOX CONCENTRATION PPM                        43.3               20.4               45.9               21.8
  THC MASS GRAMS                               5.82               3.71               3.68               4.45
  CO  MASS GRAMS                              10.20                .43                .77                .32
  CO2 MASS GRAMS                             2439.3             2680.5             2141.0             2642.2
  NOX MASS GRAMS                               6.21               5.02               6.57               5.37

  THC  GRAMS/MI                                1.65                .97               1.03               1.17
  CO   GRAMS/MI                                2.89                .11                .22                .08
  CO2  GRAMS/MI                               689.8              703.8              602.4              693.7
  NOX  GRAMS/MI                                1.76               1.32               1.05               1.41
  FUEL ECONOMY IN MPG                         12.10     12.03    11.97              13.97     12.96    12.14
  RUN TIME            SECONDS                  506.               868.               505.               868.
  MEASURED DISTANCE    MI                      3.54      7.34     3.81               3.55      7.36     3.81
  SCF, DRY                                     .966      .970     .972               .968      .971     .972
       DFC. WET (DRY)                               .891( .876)                           .898( .883)
       TOT VOL (SCM) / SAM BLR (SCM)                201.7/  .00                           201.7/  .00

COMPOSITE RESULTS                                                                              3-BAG      (4-BAG)
   TEST NUMBER         243                                      CARBON DIOXIDE       G/MI      673.0     ( 670.0)
   BAROMETER    MM HG  735.8                                    FUEL ECONOMY         MPG       12.49     ( 12.54)
   HUMIDITY     G/KG    11.0                                    HYDROCARBONS (THC)   G/MI       1.13     (  1.19)
   TEMPERATURE  DEG C   26.1                                    CARBON MONOXIDE      G/MI        .72     (   .71)
                                                                OXIDES OF NITROGEN   G/MI       1.55     (  1.58)
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COMPUTER PRINTOUTS OF REGULATED EMISSIONS AND FUEL ECONOMY FROM TEST VEHICLE 3, A 1983 BUICK REGAL

Test Fuel	Test No.	Table C-
Baseline (EM-905-F)	311	32
	312	33
	313	34
	314	35
	315	36
	316	37
10% Ethanol (EM-906-F)	321	38
	322	39
	323	40
16.4% MTBE (EM-907-F)	331	41
	332	42
	333	43
19.1% ETBE (EM-908-F)	341	44
	342	45
	343	46

TABLE C-32

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                        SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                     FTP   - VEHICLE EMISSIONS RESULTS -
                                           PROJECT 08-2809-001

TEST NO.   311          RUN                    VEHICLE NO.691                    TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL                 DATE    4/ 4/90                   ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                     BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-905-F
TRANSMISSION A3                                DYNO NO.      3                   ODOMETER 133643. KM( 83042. MILES)

BAROMETER 740.16 MM HG(29.14 IN HG)            DRY BULB TEMP. 20.6 DEG C(69.0 DEG F)
RELATIVE HUMIDITY  47. PCT                     ABS. HUMIDITY  7.3 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .90
BAG RESULTS
  BAG NUMBER                                       1                  2                  3                  4
  DESCRIPTION                                COLD TRANSIENT       STABILIZED        HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)               807.7 (31.8)       810.3 (31.9)       810.3 (31.9)       807.7 (31.8)
  BLOWER INLET P MM. H2O(IN. H2O)             807.7 (31.8)       810.3 (31.9)       810.3 (31.9)       807.7 (31.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)            41.7 (107.0)       40.0 (104.0)       41.7 (107.0)       40.0 (104.0)
  BLOWER REVOLUTIONS                             40500.             69416.             40433.             69450.
  TOT FLOW STD. CU. METRES(SCF)                74.9 ( 2644.)     128.7 ( 4545.)      74.7 ( 2639.)     128.8 ( 4548.)
  THC SAMPLE METER/RANGE/PPM               15.4/  3/ 154.     26.4/  2/  26.     66.5/  2/  66.     23.9/  2/  24.
  THC BCKGRD METER/RANGE/PPM                1.3/  3/  13.     12.1/  2/  12.     10.9/  2/  11.      9.5/  2/   9.
  CO  SAMPLE METER/RANGE/PPM               59.9/  1/ 532.     31.9/ 12/  31.     54.2/  1/ 469.     28.4/ 12/  28.
  CO  BCKGRD METER/RANGE/PPM                 .1/  1/   1.      1.5/ 12/   1.       .1/  1/   1.      1.0/ 12/   1.
  CO2 SAMPLE METER/RANGE/PCT               69.2/  1/1.2744    36.4/ 14/ .7851    60.0/  1/1.1017    85.6/ 14/ .7681
  CO2 BCKGRD METER/RANGE/PCT                2.5/  1/ .0441    12.8/ 14/ .0430     2.3/  1/ .0406    13.3/ 14/ .0450
  NOX SAMPLE METER/RANGE/PPM               57.6/  2/ 57.6     28.8/  2/ 28.9     53.7/  2/ 53.7     29.5/  2/ 29.5
  NOX BCKGRD METER/RANGE/PPM                 .1/  2/   .1       .1/  2/   .1       .1/  2/   .1       .0/  2/   .0
  DILUTION FACTOR                                10.14              17.19              11.79              17.59
  THC CONCENTRATION PPM                          142.               15.                56.                15.
  CO  CONCENTRATION PPM                          511.               29.                452.               26.
  CO2 CONCENTRATION PCT                         1.2346             .7446              1.0646             .7256
  NOX CONCENTRATION PPM                          57.5               28.8               53.6               29.5
  THC MASS GRAMS                                 6.09               1.10               2.40               1.09
  CO  MASS GRAMS                                44.54               4.33              39.29               3.90
  CO2 MASS GRAMS                                1692.7             1754.5             1456.6             1711.3
  NOX MASS GRAMS                                 7.41               6.37               6.89               6.55

  THC  GRAMS/MI                                  1.70                .28                .67                .28
  CO   GRAMS/MI                                 12.42               1.11              10.99               1.01
  CO2  GRAMS/MI                                 472.1              451.0              407.5              441.5
  NOX  GRAMS/MI                                  2.07               1.64               1.93               1.69
  FUEL ECONOMY IN MPG                           18.22      19.09    19.97              21.22      20.78   20.40
  RUN TIME              SECONDS                 506.                867.               505.               868.
  MEASURED DISTANCE     MI                      3.59       7.48     3.89               3.57       7.45    3.88
  SCF, DRY                                      .973       .976     .978               .975       .977    .978
       DFC, WET (DRY)                                 .927( .913)                             .933( .919)
       TOT VOL (SCM) / SAM BLR (SCM)                  203.6/  .00                             203.5/  .00

COMPOSITE RESULTS
  TEST NUMBER          311                                                                3-BAG       (4-BAG)
  BAROMETER    MM HG  740.2                          CARBON DIOXIDE        G/MI          443.5      ( 440.6)
  HUMIDITY     G/KG     7.3                          FUEL ECONOMY          MPG           19.90      ( 20.02)
  TEMPERATURE  DEG C   20.6                          HYDROCARBONS (THC)    G/MI            .68      (   .68)
                                                     CARBON MONOXIDE       G/MI           6.14      (  6.12)
                                                     OXIDES OF NITROGEN    G/MI           1.80      (  1.82)
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TABLE C-33

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   312          RUN                VEHICLE NO.691                    TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL             DATE     4/ 5/90                  ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                 BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-905-F
TRANSMISSION A3                            DYNO NO.      3                   ODOMETER 133672. KM( 83060. MILES)

BAROMETER 736.60 MM HG(29.00 IN HG)        DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  57. PCT                 ABS. HUMIDITY  9.4 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .96
BAG RESULTS
  BAG NUMBER                                    1                2                 3                 4
  DESCRIPTION                             COLD TRANSIENT    STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)            807.7 (31.8)     807.7 (31.8)     800.1 (31.5)     789.9 (31.1)
  BLOWER INLET P MM. H2O(IN. H2O)          807.7 (31.8)     807.7 (31.8)     800.1 (31.5)     789.9 (31.1)
  BLOWER INLET TEMP. DEG. C(DEG. F)         42.2 (108.0)     41.1 (106.0)     41.7 (107.0)     40.6 (105.0)
  BLOWER REVOLUTIONS                          40510.           69515.           40457.           69424.
  TOT FLOW STD. CU. METRES(SCF)             74.4 ( 2628.)    128.0 ( 4519.)    74.5 ( 2630.)    128.3 ( 4529.)
  THC SAMPLE METER/RANGE/PPM               20.9/   3/ 208.   26.3/   2/  26.   57.1/   2/  57.   25.4/   2/  25.
  THC BCKGRD METER/RANGE/PPM                1.2/   3/  12.   12.0/   2/  12.   11.1/   2/  11.   11.8/   2/  12.
  CO  SAMPLE METER/RANGE/PPM               96.6/   1/1026.   15.3/  12/  15.   73.9/  14/ 352.   30.0/  12/  29.
  CO  BCKGRD METER/RANGE/PPM                 .2/   1/   1.    1.0/  12/   1.     .2/  14/   1.     .4/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT               69.7/   1/1.2838  86.2/  14/ .7808  60.6/   1/1.1130  86.0/  14/ .7765
  CO2 BCKGRD METER/RANGE/PCT                2.5/   1/ .0441  12.6/  14/ .0422   2.7/   1/ .0476  13.7/  14/ .0466
  NOX SAMPLE METER/RANGE/PPM               38.9/   2/ 38.9   27.3/   2/ 27.4   52.9/   2/ 52.9   29.2/   2/ 29.2
  NOX BCKGRD METER/RANGE/PPM                 .0/   2/   .0     .0/   2/   .0     .1/   2/   .1     .1/   2/   .1
  DILUTION FACTOR                              9.69             17.32             11.80            17.39
  THC CONCENTRATION PPM                        198.              15.               46.              14.
  CO  CONCENTRATION PPM                        981.              13.              337.              28.
  CO2 CONCENTRATION PCT                       1.2443            .7410            1.0694            .7326
  NOX CONCENTRATION PPM                        38.9             27.4              52.8             29.2
  THC MASS GRAMS                               8.44             1.09              1.98             1.04
  CO  MASS GRAMS                              85.00             2.00             29.23             4.18
  CO2 MASS GRAMS                             1695.6           1736.2            1458.4           1720.5
  NOX MASS GRAMS                               5.32             6.43              7.22             6.86

  THC  GRAMS/MI                                2.38              .29               .56              .27
  CO   GRAMS/MI                               24.01              .53              8.25             1.09
  CO2  GRAMS/MI                               479.0            457.4             411.5            448.6
  NOX  GRAMS/MI                                1.50             1.69              2.04             1.79
  FUEL ECONOMY IN MPG                         17.27    18.46   19.73             21.25    20.63   20.08
  RUN TIME              SECONDS               505.             868.              505.             867.
  MEASURED DISTANCE     MI                    3.54     7.34    3.80              3.54     7.38    3.84
  SCF, DRY                                    .970     .973    .975              .972     .974    .975
      DFC, WET (DRY)                              .926( .909)                         .932( .915)
      TOT VOL (SCM) / SAM BLR (SCM)               202.4/   .00                        202.8/   .00

COMPOSITE RESULTS                                                                     3-BAG      (4-BAG)
  TEST NUMBER          312                         CARBON DIOXIDE        G/MI         449.2      ( 446.7)
  BAROMETER    MM HG   736.6                       FUEL ECONOMY          MPG          19.54      ( 19.64)
  HUMIDITY     G/KG      9.4                       HYDROCARBONS (THC)    G/MI           .80      (   .79)
  TEMPERATURE  DEG C    21.7                       CARBON MONOXIDE       G/MI          7.52      (  7.60)
                                                   OXIDES OF NITROGEN    G/MI          1.75      (  1.78)
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TABLE C-34

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                      SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                   FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   313          RUN                   VEHICLE NO.691                  TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL                DATE    4/11/90                 ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                    BAG CART NO. 2 / CVS NO.  2     GASOLINE  EM-905-F
TRANSMISSION A3                               DYNO NO.      3                 ODOMETER 133868. KM( 83182. MILES)

BAROMETER 747.52 MM HG(29.43 IN HG)           DRY BULB TEMP. 20.6 DEG C(69.0 DEG F)
RELATIVE HUMIDITY  43. PCT                    ABS. HUMIDITY  6.6 GM/KG        NOX HUMIDITY CORRECTION FACTOR   .88
BAG RESULTS
  BAG NUMBER                                      1                2                 3                4
  DESCRIPTION                               COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)              810.3 (31.9)     810.3 (31.9)     810.3 (31.9)     807.7 (31.8)
  BLOWER INLET P MM. H2O(IN. H2O)            807.7 (31.8)     807.7 (31.8)     807.7 (31.8)     805.2 (31.7)
  BLOWER INLET TEMP. DEG. C(DEG. F)           42.2 (108.0)     38.3 (101.0)     41.7 (107.0)     39.4 (103.0)
  BLOWER REVOLUTIONS                           40508.           69441.           40427.           69472.
  TOT FLOW STD. CU. METRES(SCF)               75.7 ( 2671.)    130.7 ( 4613.)    75.6 ( 2668.)    130.5 ( 4607.)
  THC SAMPLE METER/RANGE/PPM                17.6/   3/ 176.  21.5/   2/  21.   50.6/   2/  50.   22.6/   2/  22.
  THC BCKGRD METER/RANGE/PPM                  .7/   3/   7.   6.7/   2/   7.    6.8/   2/   7.    6.5/   2/   6.
  CO  SAMPLE METER/RANGE/PPM                81.8/   1/ 808.  59.6/  12/  59.   53.7/   1/ 464.   84.5/  12/  84.
  CO  BCKGRD METER/RANGE/PPM                  .0/   1/   0.    .5/  12/   0.     .1/   1/   1.     .6/  12/   1.
  CO2 SAMPLE METER/RANGE/PCT                69.4/   1/1.2782 86.0/  14/ .7765  60.1/   1/1.1036  85.1/  14/ .7576
  CO2 BCKGRD METER/RANGE/PCT                 2.3/   1/ .0406 12.0/  14/ .0399   2.4/   1/ .0423  12.3/  14/ .0411
  NOX SAMPLE METER/RANGE/PPM                49.3/   2/ 49.3  29.5/   2/ 29.5   57.7/   2/ 57.7   32.1/   2/ 32.1
  NOX BCKGRD METER/RANGE/PPM                  .2/   2/   .2    .1/   2/   .1     .2/   2/   .2     .0/   2/   .0
  DILUTION FACTOR                               9.90             17.33            11.79            17.70
  THC CONCENTRATION PPM                         169.             15.              44.              16.
  CO  CONCENTRATION PPM                         777.             57.              447.             82.
  CO2 CONCENTRATION PCT                         1.2417           .7389            1.0649           .7186
  NOX CONCENTRATION PPM                         49.1             29.5             57.5             32.1
  THC MASS GRAMS                                7.34             1.13             1.90             1.22
  CO  MASS GRAMS                                68.44            8.64             39.32            12.39
  CO2 MASS GRAMS                                1719.9           1767.5           1473.4           1717.1
  NOX MASS GRAMS                                6.26             6.49             7.33             7.07

  THC  GRAMS/MI                                 2.04             .29              .53              .32
  CO   GRAMS/MI                                 19.05            2.23             10.96            3.20
  CO2  GRAMS/MI                                 478.8            455.5            410.7            444.1
  NOX  GRAMS/MI                                 1.74             1.67             2.04             1.83
  FUEL ECONOMY IN MPG                           17.58    18.62   19.69            21.09    20.57   20.12
  RUN TIME              SECONDS                 505.             867.             505.             867.
  MEASURED DISTANCE     MI                      3.59     7.47    3.88             3.59     7.45    3.87
  SCF, DRY                                      .975     .977    .979             .976     .978    .979
      DFC, WET (DRY)                                 .926( .913)                       .933( .920)
      TOT VOL (SCM) / SAM BLR (SCM)                 206.3/   .00                      206.0/   .00

COMPOSITE RESULTS                                                                        3-BAG      (4-BAG)
  TEST NUMBER          313                             CARBON DIOXIDE        G/MI        448.1      ( 444.7)
  BAROMETER     MM HG  747.5                           FUEL ECONOMY          MPG         19.56      ( 19.68)
  HUMIDITY      G/KG     6.6                           HYDROCARBONS (THC)    G/MI          .72      (   .73)
  TEMPERATURE   DEG C   20.6                           CARBON MONOXIDE       G/MI         8.10      (  8.39)
                                                       OXIDES OF NITROGEN    G/MI         1.79      (  1.83)
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TABLE C-35

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 314 RUN	VEHICLE NO.691	TEST WEIGHT 1814. KG(4000. LBS)
VEHICLE MODEL 83 BUICK REGAL	DATE 4/18/90	ACTUAL ROAD LOAD 8.4 KW(11.3 HP)
ENGINE 3.8 L(232. CID) V-8	BAG CART NO. 2 / CVS NO. 2	GASOLINE EM-905-F
TRANSMISSION A3	DYNO NO. 3	ODOMETER 134097. KM(83324. MILES)
BAROMETER 743.20 MM HG(29.26 IN HG)	DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)	
RELATIVE HUMIDITY 56. PCT	ABS. HUMIDITY 9.3 GM/KG	NOX HUMIDITY CORRECTION FACTOR .96

BAG RESULTS

BAG NUMBER DESCRIPTION	1 COLD TRANSIENT		2 STABILIZED	3 HOT TRANSIENT		4 STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	802.6 (31.6)		802.6 (31.6)	802.6 (31.6)		795.0 (31.3)
BLOWER INLET P MM. H2O(IN. H2O)	800.1 (31.5)		800.1 (31.5)	800.1 (31.5)		792.5 (31.2)
BLOWER INLET TEMP. DEG. C(DEG. F)	42.8 (109.0)		40.6 (105.0)	42.2 (108.0)		40.0 (104.0)
BLOWER REVOLUTIONS	40519.		69493.	40426.		69356.
TOT FLOW STD. CU. METRES(SCF)	75.2 (2655.)		129.5 (4572.)	75.1 (2651.)		129.5 (4573.)
THC SAMPLE METER/RANGE/PPM	17.9/ 3/ 179.		25.5/ 2/ 25.	60.6/ 2/ 60.		24.1/ 2/ 24.
THC BCKGRD METER/RANGE/PPM	1.1/ 3/ 11.		10.6/ 2/ 10.	10.5/ 2/ 10.		9.3/ 2/ 9.
CO SAMPLE METER/RANGE/PPM	74.9/ 1/ 715.		31.1/ 12/ 30.	54.1/ 1/ 468.		37.0/ 12/ 36.
CO BCKGRD METER/RANGE/PPM	.1/ 1/ 1.		.7/ 12/ 1.	.0/ 1/ 0.		.4/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	70.0/ 1/1.2895		85.8/ 14/ .7723	59.5/ 1/1.0924		85.5/ 14/ .7659
CO2 BCKGRD METER/RANGE/PCT	2.5/ 1/ .0441		12.8/ 14/ .0430	2.6/ 1/ .0459		13.1/ 14/ .0442
NOX SAMPLE METER/RANGE/PPM	40.2/ 2/ 40.2		30.2/ 2/ 30.2	51.1/ 2/ 51.1		28.1/ 2/ 28.2
NOX BCKGRD METER/RANGE/PPM	.1/ 2/ .1		.1/ 2/ .1	.1/ 2/ .1		.1/ 2/ .1
DILUTION FACTOR	9.88		17.48	11.89		17.61
THC CONCENTRATION PPM	169.		15.	50.		15.
CO CONCENTRATION PPM	684.		29.	450.		35.
CO2 CONCENTRATION PCT	1.2498		.7317	1.0504		.7243
NOX CONCENTRATION PPM	40.1		30.2	51.0		28.1
THC MASS GRAMS	7.27		1.14	2.17		1.13
CO MASS GRAMS	59.90		4.34	39.33		5.23
CO2 MASS GRAMS	1720.7		1734.7	1444.0		1717.2
NOX MASS GRAMS	6.62		7.14	7.01		6.65
THC GRAMS/MI	2.05		.30	.61		.29
CO GRAMS/MI	16.88		1.13	11.06		1.35
CO2 GRAMS/MI	484.8		451.8	406.2		442.7
NOX GRAMS/MI	1.86		1.86	1.97		1.71
FUEL ECONOMY IN MPG	17.49	18.68	19.93	21.29	20.77	20.32
RUN TIME SECONDS	505.		867.	505.		867.
MEASURED DISTANCE MI	3.55	7.39	3.84	3.56	7.43	3.88
SCF, DRY	.970	.973	.975	.972	.974	.975
DFC, WET (DRY)		.927(.910)			.933(.916)	
TOT VOL (SCM) / SAM BLR (SCM)		204.7/ .00			204.6/ .00	

COMPOSITE RESULTS

TEST NUMBER		314
BAROMETER	MM HG	743.2
HUMIDITY	G/KG	9.3
TEMPERATURE	DEG C	21.7

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	446.1	(443.5)
FUEL ECONOMY	MPG	19.71	(19.82)
HYDROCARBONS (THC)	G/MI	.74	(.74)
CARBON MONOXIDE	G/MI	7.10	(7.16)
OXIDES OF NITROGEN	G/MI	1.89	(1.85)

TABLE C-36

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                 FTP   - VEHICLE EMISSIONS RESULTS -
                                       PROJECT 08-2809-001

TEST NO.   315          RUN                   VEHICLE NO.691                    TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL                DATE    4/25/90                   ACTUAL ROAD LOAD   6.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-6                    BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-905-F
TRANSMISSION A3                               DYNO NO.      3                   ODOMETER 134322. KM( 83464. MILES)

BAROMETER 735.58 MM HG(28.96 IN HG)           DRY BULB TEMP. 20.6 DEG C(69.0 DEG F)
RELATIVE HUMIDITY  68. PCT                    ABS. HUMIDITY 10.6 GM/KG          NOX HUMIDITY CORRECTION FACTOR  1.00
BAG RESULTS
  BAG NUMBER                                        1                  2                  3                  4
  DESCRIPTION                                COLD TRANSIENT       STABILIZED       HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)              789.9 (31.1)      787.4 (31.0)      787.4 (31.0)      784.9 (30.9)
  BLOWER INLET P MM. H2O(IN. H2O)            787.4 (31.0)      787.4 (31.0)      787.4 (31.0)      782.3 (30.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)           42.2 (108.0)      39.4 (103.0)      41.7 (107.0)      40.6 (105.0)
  BLOWER REVOLUTIONS                           40481.            69519.            40472.            69429.
  TOT FLOW STD. CU. METRES(SCF)              74.5 ( 2630.)    128.6 ( 4540.)     74.5 ( 2632.)    128.2 ( 4527.)
  THC SAMPLE METER/RANGE/PPM               25.2/   3/ 251.   27.6/   2/  27.   57.1/   2/  57.   27.4/   2/  27.
  THC BCKGRD METER/RANGE/PPM                1.3/   3/  13.   13.5/   2/  13.   12.4/   2/  12.   11.1/   2/  11.
  CO  SAMPLE METER/RANGE/PPM               93.5/   1/ 978.   26.2/  12/  26.   80.8/  14/ 391.   58.9/  12/  58.
  CO  BCKGRD METER/RANGE/PPM                 .1/   1/   1.    1.0/  12/   1.     .1/  14/   0.    1.4/  12/   1.
  CO2 SAMPLE METER/RANGE/PCT               69.5/   1/1.2800  86.1/  14/ .7787  60.1/   1/1.1036  85.3/  14/ .7618
  CO2 BCKGRD METER/RANGE/PCT                2.5/   1/ .0441  12.9/  14/ .0434   2.7/   1/ .0476  12.7/  14/ .0426
  NOX SAMPLE METER/RANGE/PPM               43.9/   2/ 43.9   29.6/   2/ 29.6   57.7/   2/ 57.7   31.5/   2/ 31.5
  NOX BCKGRD METER/RANGE/PPM                 .0/   2/   .0     .1/   2/   .1     .3/   2/   .3     .1/   2/   .1
  DILUTION FACTOR                               9.72             17.34             11.86             17.65
  THC CONCENTRATION PPM                        240.               15.               45.               17.
  CO  CONCENTRATION PPM                        932.               24.              374.               55.
  CO2 CONCENTRATION PCT                       1.2405             .7378            1.0600             .7215
  NOX CONCENTRATION PPM                        43.9              29.6              57.4              31.4
  THC MASS GRAMS                              10.24              1.09              1.94              1.23
  CO  MASS GRAMS                              80.83              3.55             32.49              8.19
  CO2 MASS GRAMS                             1691.5            1736.7            1446.5            1693.7
  NOX MASS GRAMS                               6.23              7.24              8.15              7.68

  THC  GRAMS/MI                                2.90               .29               .55               .32
  CO   GRAMS/MI                               22.91               .94              9.23              2.15
  CO2  GRAMS/MI                               479.4             457.9             411.0             443.6
  NOX  GRAMS/MI                                1.77              1.91              2.32              2.01
  FUEL ECONOMY IN MPG                         17.27     18.44    19.68            21.20     20.68    20.22
  RUN TIME            SECONDS                 505.               868.             506.               868.
  MEASURED DISTANCE    MI                     3.53      7.32     3.79             3.52      7.34     3.82
  SCF, DRY                                    .967      .970     .971             .968      .970     .971
      DFC, WET (DRY)                               .926( .905)                         .933( .913)
      TOT VOL (SCM) / SAM BLR (SCM)               203.1/   .00                        202.8/   .00

COMPOSITE RESULTS                                                                         3-BAG      (4-BAG)
  TEST NUMBER        315                                  CARBON DIOXIDE       G/MI       449.5      ( 445.3)
  BAROMETER    MM HG  735.6                               FUEL ECONOMY         MPG        19.50      ( 19.65)
  HUMIDITY     G/KG    10.6                               HYDROCARBONS (THC)   G/MI         .90      (   .91)
  TEMPERATURE  DEG C   20.6                               CARBON MONOXIDE      G/MI        7.76      (  8.12)
                                                          OXIDES OF NITROGEN   G/MI        1.99      (  2.02)
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TABLE C-37

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                  FTP   - VEHICLE EMISSIONS RESULTS -
                                          PROJECT 08-2809-001

TEST NO.   316         RUN                 VEHICLE NO.691                    TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL             DATE    4/26/90                   ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-6                 BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-905-F
TRANSMISSION A3                            DYNO NO.      3                   ODOMETER 134351. KM( 83482. MILES)

BAROMETER 734.06 MM HG(28.90 IN HG)        DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  65. PCT                 ABS. HUMIDITY 10.8 GM/KG          NOX HUMIDITY CORRECTION FACTOR  1.00
BAG RESULTS
   BAG NUMBER                                  1                  2                  3                  4
   DESCRIPTION                           COLD TRANSIENT       STABILIZED      HOT TRANSIENT        STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)          787.4 (31.0)       787.4 (31.0)       782.3 (30.8)       784.9 (30.9)
   BLOWER INLET P MM. H2O(IN. H2O)        782.3 (30.8)       782.3 (30.8)       774.7 (30.5)       772.2 (30.4)
   BLOWER INLET TEMP. DEG. C(DEG. F)       38.3 (101.0)       38.3 (101.0)       38.9 (102.0)       40.0 (104.0)
   BLOWER REVOLUTIONS                       40528.             69572.             40469.             69440.
   TOT FLOW STD. CU. METRES(SCF)          75.0 ( 2648.)      128.7 ( 4546.)      74.9 ( 2644.)      128.2 ( 4528.)
   THC SAMPLE METER/RANGE/PPM           16.9/   3/ 169.    26.9/   2/  27.    58.7/   2/  58.    24.6/   2/  24.
   THC BCKGRD METER/RANGE/PPM            1.1/   3/  11.    11.7/   2/  12.    11.3/   2/  11.    11.3/   2/  11.
   CO  SAMPLE METER/RANGE/PPM           67.4/   1/ 621.    30.3/  12/  30.    78.2/  14/ 376.    24.0/  12/  23.
   CO  BCKGRD METER/RANGE/PPM             .0/   1/   0.      .0/  12/   0.      .0/  14/   0.      .0/  12/   0.
   CO2 SAMPLE METER/RANGE/PCT           69.6/   1/1.2819   86.1/  14/ .7787   59.0/   1/1.0830   85.0/  14/ .7555
   CO2 BCKGRD METER/RANGE/PCT            2.4/   1/ .0423   12.7/  14/ .0426    2.5/   1/ .0441   12.1/  14/ .0403
   NOX SAMPLE METER/RANGE/PPM           53.5/   2/ 53.5    28.3/   2/ 28.4    60.2/   2/ 60.2    30.1/   2/ 30.1
   NOX BCKGRD METER/RANGE/PPM             .1/   2/   .1      .2/   2/   .2      .2/   2/   .2      .1/   2/   .1
   DILUTION FACTOR                          10.01              17.34              12.09              17.88
   THC CONCENTRATION PPM                    159.               16.                48.                14.
   CO  CONCENTRATION PPM                    593.               29.                361.               23.
   CO2 CONCENTRATION PCT                    1.2438             .7385              1.0426             .7175
   NOX CONCENTRATION PPM                    53.4               28.2               60.0               30.1
   THC MASS GRAMS                            6.83               1.16               2.05               1.01
   CO  MASS GRAMS                           51.77               4.28              31.45               3.36
   CO2 MASS GRAMS                          1707.9             1740.7             1429.3             1684.3
   NOX MASS GRAMS                            7.69               6.96               8.63               7.40

   THC  GRAMS/MI                             1.93                .31                .58                .27
   CO   GRAMS/MI                            14.65               1.13               8.91                .89
   CO2  GRAMS/MI                            483.5              458.4              405.1              447.8
   NOX  GRAMS/MI                             2.18               1.83               2.44               1.97
   FUEL ECONOMY IN MPG                      17.67     18.64    19.64              21.52     20.78    20.13
   RUN TIME              SECONDS            505.               868.               505.               867.
   MEASURED DISTANCE     MI                 3.53      7.33     3.80               3.53      7.29     3.76
   SCF, DRY                                 .968      .971     .972               .970      .971     .972
        DFC, WET (DRY)                          .927( .907)                           .934( .915)
        TOT VOL (SCM) / SAM BLR (SCM)          203.7/   .00                          203.1/   .00

COMPOSITE RESULTS
   TEST NUMBER          316                                                           3-BAG      (4-BAG)
   BAROMETER     MM HG  734.1                     CARBON DIOXIDE        G/MI          449.0      ( 445.8)
   HUMIDITY      G/KG    10.8                     FUEL ECONOMY          MPG           19.66      ( 19.80)
   TEMPERATURE   DEG C   21.7                     HYDROCARBONS (THC)    G/MI            .72      (   .71)
                                                  CARBON MONOXIDE       G/MI           6.07      (  6.01)
                                                  OXIDES OF NITROGEN    G/MI           2.07      (  2.11)
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TABLE C-38

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                  SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   321          RUN             VEHICLE NO.691                    TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   33 BUICK REGAL          DATE    4/ 6/90                   ACTUAL ROAD LOAD   8.4 KW( 11.3 HP
ENGINE 3.3 L(232. CID) V-8              BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-906-F
TRANSMISSION A3                         DYNO NO.      3                   ODOMETER 133736. KM( 83100. MILES)

BAROMETER 739.39 MM HG(29.11 IN HG)     DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
RELATIVE HUMIDITY  46. PCT              ABS. HUMIDITY  7.9 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .
BAG RESULTS
   BAG NUMBER                                  1                2                 3                 4
   DESCRIPTION                          COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)          810.3 (31.9)     810.3 (31.9)     805.2 (31.7)      800.1 (31.5)
   BLOWER INLET P MM. H2O(IN. H2O)        807.7 (31.8)     807.7 (31.8)     802.6 (31.6)      800.1 (31.5)
   BLOWER INLET TEMP. DEG. C(DEG. F)       42.2 (108.0)     39.4 (103.0)     41.7 (107.0)      40.6 (105.0)
   BLOWER REVOLUTIONS                        40547.           69619.           40474.            69508.
   TOT FLOW STD. CU. METRES(SCF)           74.8 ( 2642.)   129.1 ( 4559.)    74.8 ( 2641.)    128.8 ( 4547.
   THC SAMPLE METER/RANGE/PPM           15.3/   3/ 153.  21.7/   2/  21.   47.9/   2/  47.    22.0/   2/ 2
   THC BCKGRD METER/RANGE/PPM             .8/   3/   8.   7.2/   2/   7.    6.7/   2/   7.     7.4/   2/
   CO  SAMPLE METER/RANGE/PPM           59.7/   1/ 530.  39.0/  12/  38.   53.5/  14/ 240.    43.9/  12/ 4.
   CO  BCKGRD METER/RANGE/PPM             .0/   1/   0.    .0/  12/   0.     .0/  14/   0.      .0/  12/
   CO2 SAMPLE METER/RANGE/PCT           68.0/   1/1.2518 85.1/  14/ .7576  58.4/   1/1.0718   84.3/  14/ .7
   CO2 BCKGRD METER/RANGE/PCT            2.3/   1/ .0406 11.9/  14/ .0395   2.3/   1/ .0406   12.1/  14/ .0
   NOX SAMPLE METER/RANGE/PPM           56.3/   2/ 56.3  29.8/   2/ 29.8   60.9/   2/ 60.9    32.9/   2/ 32
   NOX BCKGRD METER/RANGE/PPM             .0/   2/   .0    .0/   2/   .0     .0/   2/   .0      .0/   2/
   DILUTION FACTOR                           10.09             17.42            12.09             17.79
   THC CONCENTRATION PPM                     145.              15.              41.               15.
   CO  CONCENTRATION PPM                     509.              37.              231.              42.
   CO2 CONCENTRATION PCT                     1.2153            .7203            1.0346            .7031
   NOX CONCENTRATION PPM                     56.3              29.8             60.9              32.9
   THC MASS GRAMS                            6.53              1.14             1.86              1.15
   CO  MASS GRAMS                            44.36             5.58             20.15             6.28
   CO2 MASS GRAMS                            1664.6            1702.9           1416.9            1657.8
   NOX MASS GRAMS                            7.36              6.74             7.96              7.42

   THC  GRAMS/MI                             1.84              .30              .52               .30
   CO   GRAMS/MI                             12.48             1.45             5.68              1.64
   CO2  GRAMS/MI                             468.3             443.2            399.1             431.9
   NOX  GRAMS/MI                             2.07              1.75             2.24              1.93
   FUEL ECONOMY IN MPG                       17.22    18.12    19.04            20.75    20.09    19.51
   RUN TIME             SECONDS              505.              868.             505.              868.
   MEASURED DISTANCE    MI                   3.55     7.40     3.84             3.55     7.39     3.84
   SCF, DRY                                  .973     .976     .978             .975     .977     .978
        DFC, WET (DRY)                             .927( .914)                        .934( .920)
        TOT VOL (SCM) / SAM BLR (SCM)              203.9/   .00                       203.6/   .00

                                                                                                 3-BAG      (4
COMPOSITE RESULTS                                                     CARBON DIOXIDE       G/MI    436.3      ( 4
   TEST NUMBER        321                                             FUEL ECONOMY         MPG     19.05      ( 1
   BAROMETER   MM HG  739.4                                           HYDROCARBONS (THC)   G/MI     .68       (
   HUMIDITY    G/KG     7.9                                           CARBON MONOXIDE      G/MI    4.89       (
   TEMPERATURE DEG C   22.2                                           OXIDES OF NITROGEN   G/MI    1.95       (
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TABLE C-39

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                  FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   322          RUN               VEHICLE NO.691                       TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL            DATE     4/ 9/90                     ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-906-F
TRANSMISSION A3                           DYNO NO.      3                      ODOMETER 133777. KM( 83125. MILES)

BAROMETER 740.66 MM HG(29.16 IN HG)       DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  60. PCT                ABS. HUMIDITY 10.0 GM/KG             NOX HUMIDITY CORRECTION FACTOR   .98
BAG RESULTS
   BAG NUMBER                                     1                   2                   3                   4
   DESCRIPTION                             COLD TRANSIENT        STABILIZED        HOT TRANSIENT         STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)            810.3 (31.9)       807.7 (31.8)       807.7 (31.8)       789.9 (31.1)
   BLOWER INLET P MM. H2O(IN. H2O)          810.3 (31.9)       807.7 (31.8)       805.2 (31.7)       787.4 (31.0)
   BLOWER INLET TEMP. DEG. C(DEG. F)         42.8 (109.0)       40.0 (104.0)       42.8 (109.0)       41.7 (107.0)
   BLOWER REVOLUTIONS                          40523.             69519.             40491.             69472.
   TOT FLOW STD. CU. METRES(SCF)             74.8 ( 2642.)     129.0 ( 4557.)      74.8 ( 2641.)     128.9 ( 4552.)
   THC SAMPLE METER/RANGE/PPM              18.9/   3/ 188.    27.5/   2/  27.    55.7/   2/  55.    25.8/   2/  26.
   THC BCKGRD METER/RANGE/PPM               1.5/   3/  15.    14.6/   2/  14.    12.9/   2/  13.    10.2/   2/  10.
   CO  SAMPLE METER/RANGE/PPM              76.0/   1/ 730.    18.5/  12/  18.    80.2/  14/ 388.    44.7/  12/  44.
   CO  BCKGRD METER/RANGE/PPM                .0/   1/   0.      .2/  12/   0.      .0/  14/   0.      .5/  12/   0.
   CO2 SAMPLE METER/RANGE/PCT              68.8/   1/1.2669   85.1/  14/ .7576   59.7/   1/1.0961   84.3/  14/ .7412
   CO2 BCKGRD METER/RANGE/PCT               2.5/   1/ .0441   13.3/  14/ .0450    2.8/   1/ .0494   13.6/  14/ .0462
   NOX SAMPLE METER/RANGE/PPM              42.9/   2/ 42.9    28.3/   2/ 28.4    53.1/   2/ 53.1    28.5/   2/ 28.6
   NOX BCKGRD METER/RANGE/PPM                .0/   2/   .0      .0/   2/   .0      .1/   2/   .1      .2/   2/   .2
   DILUTION FACTOR                               9.81               17.45              11.68              17.78
   THC CONCENTRATION PPM                         175.               14.                43.                16.
   CO  CONCENTRATION PPM                         697.               17.                372.               42.
   CO2 CONCENTRATION PCT                        1.2273             .7152              1.0509             .6976
   NOX CONCENTRATION PPM                         42.9               28.4               53.0               28.4
   THC MASS GRAMS                                7.87               1.05               1.95               1.24
   CO  MASS GRAMS                               60.73               2.57              32.40               6.30
   CO2 MASS GRAMS                              1681.0             1689.7             1439.2             1646.5
   NOX MASS GRAMS                                6.01               6.85               7.42               6.84

   THC  GRAMS/MI                                 2.20                .28                .55                .32
   CO   GRAMS/MI                                17.02                .67               9.07               1.64
   CO2  GRAMS/MI                                471.1              441.3              402.9              427.6
   NOX  GRAMS/MI                                 1.68               1.79               2.08               1.78
   FUEL ECONOMY IN MPG                          16.84     17.97    19.17              20.29     19.98    19.71
   RUN TIME             SECONDS                 505.               868.               505.               868.
   MEASURED DISTANCE    MI                      3.57      7.40     3.83               3.57      7.42     3.85
   SCF, DRY                                     .968      .971     .973               .970      .972     .973
        DFC, WET (DRY)                                 .926( .908)                          .933( .915)
        TOT VOL (SCM) / SAM BLR (SCM)                  203.9/   .00                         203.7/   .00

COMPOSITE RESULTS                                                                            3-BAG      (4-BAG)
   TEST NUMBER         322                                  CARBON DIOXIDE       G/MI        436.9      ( 432.9)
   BAROMETER    MM HG  740.7                                FUEL ECONOMY         MPG         18.91      ( 19.06)
   HUMIDITY     G/KG    10.0                                HYDROCARBONS (THC)   G/MI          .75      (   .76)
   TEMPERATURE  DEG C   21.7                                CARBON MONOXIDE      G/MI         6.37      (  6.65)
                                                            OXIDES OF NITROGEN   G/MI         1.85      (  1.84)
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TABLE C-40

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                 FTP   - VEHICLE EMISSIONS RESULTS -
                                       PROJECT 08-2809-001

TEST NO.   323          RUN                  VEHICLE NO.691                  TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL               DATE    4/10/90                 ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                   BAG CART NO. 2 / CVS NO.  2     GASOLINE  EM-906-F
TRANSMISSION A3                              DYNO NO.      3                 ODOMETER 133806. KM( 83143. MILES)

BAROMETER 740.16 MM HG(29.14 IN HG)          DRY BULB TEMP. 21.1 DEG C(70.0 DEG F)
RELATIVE HUMIDITY  64. PCT                   ABS. HUMIDITY 10.3 GM/KG        NOX HUMIDITY CORRECTION FACTOR   .99
BAG RESULTS
  BAG NUMBER                                      1               2               3                4
  DESCRIPTION                               COLD TRANSIENT    STABILIZED     HOT TRANSIENT      STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             807.7 (31.8)     807.7 (31.8)     795.0 (31.3)     792.5 (31.2)
  BLOWER INLET P MM. H2O(IN. H2O)           805.2 (31.7)     805.2 (31.7)     792.5 (31.2)     787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)          43.9 (111.0)     40.0 (104.0)     42.2 (108.0)     41.1 (106.0)
  BLOWER REVOLUTIONS                          40506.           69454.           40405.           69449.
  TOT FLOW STD. CU. METRES(SCF)              74.6 ( 2635.)   128.9 ( 4550.)    74.8 ( 2641.)   128.9 ( 4551.)
  THC SAMPLE METER/RANGE/PPM               24.0/   3/ 239.  27.8/   2/  28.   54.7/   2/  54.   26.9/   2/  27.
  THC BCKGRD METER/RANGE/PPM                1.2/   3/  12.  13.5/   2/  13.   12.0/   2/  12.   10.2/   2/  10.
  CO  SAMPLE METER/RANGE/PPM               42.5/   2/ 757.  35.8/  12/  35.   72.2/  14/ 342.   51.9/  12/  51.
  CO  BCKGRD METER/RANGE/PPM                 .0/   2/   0.    .5/  12/   0.     .2/  14/   1.     .4/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT               68.0/   1/1.2518 84.8/  14/ .7514  59.1/   1/1.0849  84.3/  14/ .7412
  CO2 BCKGRD METER/RANGE/PCT                2.7/   1/ .0476 13.1/  14/ .0442   2.5/   1/ .0441  13.0/  14/ .0438
  NOX SAMPLE METER/RANGE/PPM               45.7/   2/ 45.7  26.8/   2/ 26.9   53.0/   2/ 53.0   28.9/   2/ 29.0
  NOX BCKGRD METER/RANGE/PPM                 .1/   2/   .1    .1/   2/   .1     .1/   2/   .1     .1/   2/   .1
  DILUTION FACTOR                              9.86             17.55            11.84            17.76
  THC CONCENTRATION PPM                       229.              15.              43.              17.
  CO  CONCENTRATION PPM                       723.              33.             327.              49.
  CO2 CONCENTRATION PCT                      1.2090            .7097           1.0445            .6998
  NOX CONCENTRATION PPM                       45.6             26.8             52.9             28.9
  THC MASS GRAMS                              10.25             1.15             1.94             1.32
  CO  MASS GRAMS                              62.83             5.01            28.46             7.35
  CO2 MASS GRAMS                             1651.8           1674.4           1430.2           1651.5
  NOX MASS GRAMS                               6.42             6.50             7.46             7.02

  THC  GRAMS/MI                                2.89              .30              .55              .35
  CO   GRAMS/MI                               17.70             1.31             7.99             1.92
  CO2  GRAMS/MI                               465.4            439.7            401.5            431.0
  NOX  GRAMS/MI                                1.81             1.71             2.09             1.83
  FUEL ECONOMY IN MPG                         16.93     18.03   19.19            20.44    19.96   19.53
  RUN TIME              SECONDS               505.              867.             505.             868.
  MEASURED DISTANCE     MI                     3.55      7.36    3.81             3.56     7.39    3.83
  SCF, DRY                                     .967      .970    .972             .969     .971    .972
      DFC, WET (DRY)                                 .927( .908)                       .933( .914)
      TOT VOL (SCM) / SAM BLR (SCM)                 203.5/   .00                      203.7/   .00

COMPOSITE RESULTS                                                                          3-BAG     (4-BAG
   TEST NUMBER        323                                    CARBON DIOXIDE        G/MI    434.5     ( 432.0
   BAROMETER    MM HG  740.2                                 FUEL ECONOMY          MPG     18.98     ( 19.08
   HUMIDITY     G/KG    10.3                                 HYDROCARBONS (THC)    G/MI      .91     (   .92
   TEMPERATURE  DEG C   21.1                                 CARBON MONOXIDE       G/MI     6.55     (  6.73
                                                             OXIDES OF NITROGEN    G/MI     1.84     (  1.87
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TABLE C-41

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                             FTP   - VEHICLE EMISSIONS RESULTS -
                                   PROJECT 08-2809-001

TEST NO.   331          RUN               VEHICLE NO.691                TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL            DATE    4/12/90               ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                BAG CART NO. 2 / CVS NO.  2   GASOLINE  EM-907-F
TRANSMISSION A3                           DYNO NO.      3               ODOMETER 133934. KM( 83223. MILES)

BAROMETER 744.73 MM HG(29.32 IN HG)       DRY BULB TEMP. 20.0 DEG C(68.0 DEG F)
RELATIVE HUMIDITY  55. PCT                ABS. HUMIDITY  8.1 GM/KG         NOX HUMIDITY CORRECTION FACTOR   .92
BAG RESULTS
  BAG NUMBER                                   1                 2                 3                 4
  DESCRIPTION                            COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)           805.2 (31.7)      805.2 (31.7)      802.6 (31.6)      800.1 (31.5)
  BLOWER INLET P MM. H2O(IN. H2O)         802.6 (31.6)      802.6 (31.6)      800.1 (31.5)      795.0 (31.3)
  BLOWER INLET TEMP. DEG. C(DEG. F)        43.3 (110.0)      40.6 (105.0)      42.8 (109.0)      40.6 (105.0)
  BLOWER REVOLUTIONS                        40527.            69465.            40452.            69484.
  TOT FLOW STD. CU. METRES(SCF)             75.3 ( 2658.)    129.7 ( 4579.)     75.2 ( 2657.)    129.8 ( 4585.)
  THC SAMPLE METER/RANGE/PPM              16.0/   3/ 160.   24.7/   2/  24.   49.5/   2/  49.   23.1/   2/  23.
  THC BCKGRD METER/RANGE/PPM               1.0/   3/  10.    9.9/   2/  10.    9.4/   2/   9.    8.6/   2/   9.
  CO  SAMPLE METER/RANGE/PPM              64.2/   1/ 582.   38.7/  12/  38.   66.7/  14/ 311.   56.8/  12/  56.
  CO  BCKGRD METER/RANGE/PPM                .2/   1/   1.    1.3/  12/   1.     .4/  14/   2.    1.0/  12/   1.
  CO2 SAMPLE METER/RANGE/PCT              69.2/   1/1.2744  85.6/  14/ .7681  58.8/   1/1.0793  84.3/  14/ .7412
  CO2 BCKGRD METER/RANGE/PCT               2.5/   1/ .0441  13.1/  14/ .0442   2.3/   1/ .0406  12.7/  14/ .0426
  NOX SAMPLE METER/RANGE/PPM              46.7/   2/ 46.7   30.5/   2/ 30.5   54.9/   2/ 54.9   29.3/   2/ 29.3
  NOX BCKGRD METER/RANGE/PPM                .1/   2/   .1     .1/   2/   .1     .1/   2/   .1     .0/   2/   .0
  DILUTION FACTOR                            9.78             17.00             11.81             17.57
  THC CONCENTRATION PPM                     151.               15.               40.               15.
  CO  CONCENTRATION PPM                     556.               36.              297.               53.
  CO2 CONCENTRATION PCT                     1.2348            .7265            1.0422             .7010
  NOX CONCENTRATION PPM                     46.6              30.5              54.8              29.3
  THC MASS GRAMS                             6.80              1.18              1.83              1.16
  CO  MASS GRAMS                            48.75              5.37             26.05              8.07
  CO2 MASS GRAMS                          1701.9            1724.8            1435.5            1666.4
  NOX MASS GRAMS                             6.18              6.96              7.26              6.71

  THC  GRAMS/MI                              1.92               .31               .51               .30
  CO   GRAMS/MI                             13.75              1.40              7.33              2.09
  CO2  GRAMS/MI                            460.1             448.5             404.2             432.1
  NOX  GRAMS/MI                              1.74              1.81              2.04              1.74
  FUEL ECONOMY IN MPG                       16.70     17.72   18.77             20.31     19.84   19.43
  RUN TIME               SECONDS            505.              867.              505.              868.
  MEASURED DISTANCE      MI                 3.55      7.39    3.85              3.55      7.41    3.86
  SCF, DRY                                  .970      .973    .975              .972      .974    .975
       DFC, WET (DRY)                              .925( .909)                         .933( .916)
       TOT VOL (SCM) / SAM BLR (SCM)              205.0/   .00                        205.1/   .00

COMPOSITE RESULTS
   TEST NUMBER        331                                                                3-BAG      (4-BAG)
   BAROMETER    MM HG  744.7                           CARBON DIOXIDE        G/MI       442.9     ( 438.0)
   HUMIDITY     G/KG     8.1                           FUEL ECONOMY          MPG        18.68     ( 18.87)
   TEMPERATURE  DEG C   20.0                           HYDROCARBONS (THC)    G/MI         .70     (   .69)
                                                       CARBON MONOXIDE       G/MI        5.57     (  5.77)
                                                       OXIDES OF NITROGEN    G/MI        1.86     (  1.84)
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TABLE C-42

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                            FTP   - VEHICLE EMISSIONS RESULTS -
                                   PROJECT 08-2809-001

TEST NO.   332          RUN  2             VEHICLE NO.691               TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL             DATE    4/17/90              ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                 BAG CART NO. 2 / CVS NO.  2  GASOLINE  EM-907-F
TRANSMISSION A3                            DYNO NO.     3               ODOMETER 134033. KM( 83284. MILES)

BAROMETER 739.14 MM HG(29.10 IN HG)        DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  65. PCT                 ABS. HUMIDITY 10.8 GM/KG     NOX HUMIDITY CORRECTION FACTOR  1.00
BAG RESULTS
  BAG NUMBER                                      1                2                 3                 4
  DESCRIPTION                               COLD TRANSIENT    STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             789.9 (31.1)     787.4 (31.0)     789.9 (31.1)      787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)           787.4 (31.0)     787.4 (31.0)     787.4 (31.0)      787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)          43.3 (110.0)     41.1 (106.0)     42.8 (109.0)      41.1 (106.0)
  BLOWER REVOLUTIONS                          40468.           69428.           40418.            69422.
  TOT FLOW STD. CU. METRES(SCF)              74.7 ( 2638.)    128.7 ( 4544.)    74.7 ( 2637.)    128.7 ( 4543.)
  THC SAMPLE METER/RANGE/PPM              16.3/   3/ 163.  25.5/   2/  25.   52.3/   2/  52.   27.9/   2/  28.
  THC BCKGRD METER/RANGE/PPM               1.1/   3/  11.  10.8/   2/  11.   11.3/   2/  11.   10.6/   2/  10.
  CO  SAMPLE METER/RANGE/PPM              66.0/   1/ 604.  22.0/  12/  21.   68.9/  14/ 323.   67.2/  12/  67.
  CO  BCKGRD METER/RANGE/PPM                .0/   1/   0.    .4/  12/   0.     .1/  14/   0.     .2/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT              68.8/   1/1.2669 85.3/  14/ .7618  60.1/   1/1.1036  84.4/  14/ .7432
  CO2 BCKGRD METER/RANGE/PCT               2.3/   1/ .0406 12.6/  14/ .0422   2.7/   1/ .0476  13.2/  14/ .0446
  NOX SAMPLE METER/RANGE/PPM              50.1/   2/ 50.1  30.5/   2/ 30.5   54.6/   2/ 54.6   26.6/   2/ 26.7
  NOX BCKGRD METER/RANGE/PPM                .1/   2/   .1    .2/   2/   .2     .2/   2/   .2     .1/   2/   .1
  DILUTION FACTOR                              9.82             17.17             11.55            17.49
  THC CONCENTRATION PPM                       153.              15.               42.              18.
  CO  CONCENTRATION PPM                       576.              20.              309.              64.
  CO2 CONCENTRATION PCT                       1.2304           .7220             1.0601           .7012
  NOX CONCENTRATION PPM                       50.0              30.4              54.4             26.6
  THC MASS GRAMS                               6.84              1.17              1.86             1.37
  CO  MASS GRAMS                              50.10              3.03             26.87             9.60
  CO2 MASS GRAMS                             1682.9            1701.0            1449.4           1651.8
  NOX MASS GRAMS                               7.15              7.48              7.78             6.54

  THC  GRAMS/MI                                1.91               .31               .52              .36
  CO   GRAMS/MI                               13.98               .79              7.54             2.54
  CO2  GRAMS/MI                               469.7             444.6             406.7            437.2
  NOX  GRAMS/MI                                2.00              1.96              2.18             1.73
  FUEL ECONOMY IN MPG                         17.04     17.98   18.97             20.18     19.64  19.17
  RUN TIME           SECONDS                  505.              867.              505.             868.
  MEASURED DISTANCE   MI                      3.58      7.41    3.83              3.56      7.34   3.78
  SCF, DRY                                    .967      .970    .972              .968      .971   .972
       DFC, WET (DRY)                              .926( .906)                          .932( .913)
       TOT VOL (SCM) / SAM BLR (SCM)              203.4/   .00                          203.4/   .00

COMPOSITE RESULTS
  TEST NUMBER          332                                                           3-BAG     (4-BAG
  BAROMETER    MM HG  739.1                     CARBON DIOXIDE       G/MI     439.4     ( 437.1
  HUMIDITY     G/KG    10.8                     FUEL ECONOMY         MPG      18.84     ( 18.89
  TEMPERATURE  DEG C   21.7                     HYDROCARBONS (THC)   G/MI       .70     (   .72
                                                CARBON MONOXIDE      G/MI      5.39     (  5.92
                                                OXIDES OF NITROGEN   G/MI      2.03     (  1.96
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TABLE C-43

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                   SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                 FTP   - VEHICLE EMISSIONS RESULTS -
                                      PROJECT 08-2809-001

TEST NO.   333          RUN               VEHICLE NO.691                     TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL            DATE    4/16/90                    ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                BAG CART NO. 2 / CVS NO.  2        GASOLINE  EM-907-F
TRANSMISSION A3                           DYNO NO.      3                    ODOMETER 134004. KM( 83266. MILES)

BAROMETER 744.73 MM HG(29.32 IN HG)       DRY BULB TEMP. 20.6 DEG C(69.0 DEG F)
RELATIVE HUMIDITY  63. PCT                ABS. HUMIDITY  9.8 GM/KG           NOX HUMIDITY CORRECTION FACTOR   .97
BAG RESULTS
  BAG NUMBER                                   1                2                 3                  4
  DESCRIPTION                           COLD TRANSIENT     STABILIZED       HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)          787.4 (31.0)     787.4 (31.0)     787.4 (31.0)      787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)        787.4 (31.0)     787.4 (31.0)     787.4 (31.0)      787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)       43.3 (110.0)     41.1 (106.0)     42.8 (109.0)      40.6 (105.0)
  BLOWER REVOLUTIONS                        40555.           69549.           40476.            69490.
  TOT FLOW STD. CU. METRES(SCF)           75.5 ( 2666.)   130.0 ( 4591.)    75.4 ( 2663.)    130.0 ( 4591.)
  THC SAMPLE METER/RANGE/PPM            13.2/  3/ 132.   27.7/  2/  27.   58.0/  2/  57.    26.4/  2/  26.
  THC BCKGRD METER/RANGE/PPM             1.2/  3/  12.   11.6/  2/  11.   11.5/  2/  11.    10.3/  2/  10.
  CO  SAMPLE METER/RANGE/PPM            55.7/  1/ 486.   56.7/ 12/  56.   82.8/ 14/ 403.    38.3/ 12/  38.
  CO  BCKGRD METER/RANGE/PPM              .0/  1/   0.     .5/ 12/   0.     .0/ 14/   0.      .5/ 12/   0.
  CO2 SAMPLE METER/RANGE/PCT            69.4/  1/1.2782  85.1/ 14/ .7576  59.6/  1/1.0943   84.8/ 14/ .7514
  CO2 BCKGRD METER/RANGE/PCT             2.5/  1/ .0441  12.9/ 14/ .0434   2.6/  1/ .0459   13.4/ 14/ .0454
  NOX SAMPLE METER/RANGE/PPM            43.4/  2/ 43.4   29.9/  2/ 29.9   52.8/  2/ 52.8    26.9/  2/ 27.0
  NOX BCKGRD METER/RANGE/PPM              .1/  2/   .1     .0/  2/   .0     .1/  2/   .1      .1/  2/   .1
  DILUTION FACTOR                            9.84             17.19            11.56             17.37
  THC CONCENTRATION PPM                      121.              17.              47.               17.
  CO  CONCENTRATION PPM                      463.              54.             386.               36.
  CO2 CONCENTRATION PCT                     1.2385            .7167           1.0524             .7086
  NOX CONCENTRATION PPM                      43.3             29.9             52.7              26.9
  THC MASS GRAMS                             5.48             1.29             2.13              1.29
  CO  MASS GRAMS                            40.72             8.11            33.91              5.42
  CO2 MASS GRAMS                           1712.2           1705.9           1453.3            1686.9
  NOX MASS GRAMS                             6.07             7.23             7.38              6.48

  THC  GRAMS/MI                              1.52              .34              .59               .34
  CO   GRAMS/MI                             11.34             2.10             9.47              1.41
  CO2  GRAMS/MI                             476.8            442.2            406.1             438.7
  NOX  GRAMS/MI                              1.69             1.87             2.06              1.69
  FUEL ECONOMY IN MPG                       16.98     17.96   18.98            20.05     19.59   19.18
  RUN TIME              SECONDS             505.              868.             505.              868.
  MEASURED DISTANCE     MI                  3.59      7.45    3.86             3.58      7.42    3.85
  SCF, DRY                                  .967      .970    .972             .969      .971    .972
      DFC, WET (DRY)                             .926( .907)                        .932( .913)
      TOT VOL (SCM) / SAM BLR (SCM)             205.5/   .00                       205.5/   .00

COMPOSITE RESULTS                                                                          3-BAG      (4-BAG)
  TEST NUMBER        333                               CARBON DIOXIDE        G/MI         439.5      ( 438.4)
  BAROMETER    MM HG  744.7                            FUEL ECONOMY          MPG          18.80      ( 18.85)
  HUMIDITY     G/KG     9.8                            HYDROCARBONS (THC)    G/MI           .65      (   .65)
  TEMPERATURE  DEG C   20.6                            CARBON MONOXIDE       G/MI          6.04      (  5.84)
                                                       OXIDES OF NITROGEN    G/MI          1.89      (  1.83)
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TABLE C-44

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                           FTP   - VEHICLE EMISSIONS RESULTS -
                                  PROJECT 08-2809-001

TEST NO.   341          RUN                VEHICLE NO.691                     TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL             DATE     4/19/90                   ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                 BAG CART NO. 2 / CVS NO.  2        GASOLINE  EM-908-F
TRANSMISSION A3                            DYNO NO.      3                    ODOMETER 134161. KM( 83364. MILES)

BAROMETER 743.46 MM HG(29.27 IN HG)        DRY BULB TEMP. 20.6 DEG C(69.0 DEG F)
RELATIVE HUMIDITY  63. PCT                 ABS. HUMIDITY  9.8 GM/KG           NOX HUMIDITY CORRECTION FACTOR   .9
BAG RESULTS
  BAG NUMBER                                    1                 2                  3                  4
  DESCRIPTION                            COLD TRANSIENT      STABILIZED        HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)           795.0 (31.3)      795.0 (31.3)      795.0 (31.3)       787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)         792.5 (31.2)      792.5 (31.2)      787.4 (31.0)       787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)        43.3 (110.0)      41.7 (107.0)      42.2 (108.0)       40.6 (105.0)
  BLOWER REVOLUTIONS                        40536.            69468.            40446.             69359.
  TOT FLOW STD. CU. METRES(SCF)          75.3 ( 2658.)    129.4 ( 4568.)     75.3 ( 2658.)      129.5 ( 4573.)
  THC SAMPLE METER/RANGE/PPM            17.3/  3/ 173.    28.2/  2/  28.    51.1/  2/  51.     26.5/  2/  26.
  THC BCKGRD METER/RANGE/PPM             1.4/  3/  14.    14.1/  2/  14.    12.3/  2/  12.      9.7/  2/  10.
  CO  SAMPLE METER/RANGE/PPM            58.8/  1/ 520.    43.1/ 12/  42.    70.3/ 14/ 331.     47.0/ 13/ 110.
  CO  BCKGRD METER/RANGE/PPM              .0/  1/   0.      .6/ 12/   1.      .1/ 14/   0.       .1/ 13/   0.
  CO2 SAMPLE METER/RANGE/PCT            68.8/  1/1.2669   85.7/ 14/ .7702   60.2/  1/1.1055    84.9/ 14/ .753
  CO2 BCKGRD METER/RANGE/PCT             2.5/  1/ .0441   12.8/ 14/ .0430    2.4/  1/ .0423    12.4/ 14/ .041
  NOX SAMPLE METER/RANGE/PPM            52.6/  2/ 52.6    30.0/  2/ 30.0    55.7/  2/ 55.7     28.0/  2/ 28.1
  NOX BCKGRD METER/RANGE/PPM              .0/  2/   .0      .1/  2/   .1      .2/  2/   .2       .2/  2/   .2
  DILUTION FACTOR                           9.90              16.99             11.56              17.22
  THC CONCENTRATION PPM                     160.              15.               39.                17.
  CO  CONCENTRATION PPM                     496.              40.               317.               106.
  CO2 CONCENTRATION PCT                     1.2272            .7297             1.0668             .7144
  NOX CONCENTRATION PPM                     52.6              30.0              55.5               27.9
  THC MASS GRAMS                            7.21              1.15              1.78               1.33
  CO  MASS GRAMS                            43.49             6.07              27.76              15.91
  CO2 MASS GRAMS                            1691.1            1728.2            1470.4             1694.1
  NOX MASS GRAMS                            7.35              7.20              7.76               6.70

  THC  GRAMS/MI                             2.01              .30               .50                .34
  CO   GRAMS/MI                             12.14             1.57              7.78               4.10
  CO2  GRAMS/MI                             472.1             448.1             412.2              436.2
  NOX  GRAMS/MI                             2.05              1.87              2.18               1.73
  FUEL ECONOMY IN MPG                       17.02     17.87   18.75             19.87     19.45    19.08
  RUN TIME              SECONDS             505.              867.              505.               868.
  MEASURED DISTANCE     MI                  3.58      7.44    3.86              3.57      7.45     3.88
  SCF, DRY                                  .967      .970    .972              .969      .971     .972
     DFC, WET (DRY)                               .926( .907)                         .931( .912)
     TOT VOL (SCM) / SAM BLR (SCM)               204.6/  .00                         204.8/  .00

COMPOSITE RESULTS                                                                         3-BAG     (4-B
  TEST NUMBER          341                                  CARBON DIOXIDE       G/MI     443.2     ( 439.
  BAROMETER    MM HG  743.5                                 FUEL ECONOMY         MPG      18.64     ( 18.
  HUMIDITY     G/KG     9.8                                 HYDROCARBONS (THC)   G/MI       .71     (  .
  TEMPERATURE  DEG C   20.6                                 CARBON MONOXIDE      G/MI      5.46     ( 6.
                                                            OXIDES OF NITROGEN   G/MI      1.99     ( 1.
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TABLE C-45

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            SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                          FTP   - VEHICLE EMISSIONS RESULTS -
                                PROJECT 08-2809-001

EST NO.   342          RUN   2          VEHICLE NO.691               TEST WEIGHT  1814. KG( 4000. LBS)
EHICLE MODEL   83 BUICK REGAL           DATE    4/24/90              ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
NGINE 3.8 L(232. CID) V-8               BAG CART NO. 2 / CVS NO.  2  GASOLINE  EM-908-F
RANSMISSION A3                          DYNO NO.      3              ODOMETER 134260. KM( 83425. MILES)

AROMETER 736.35 MM HG(28.99 IN HG)      DRY BULB TEMP. 20.0 DEG C(68.0 DEG F)
ELATIVE HUMIDITY  55. PCT               ABS. HUMIDITY  8.2 GM/KG      NOX HUMIDITY CORRECTION FACTOR   .92
AG RESULTS
  BAG NUMBER                                 1                2                3                4
  DESCRIPTION                         COLD TRANSIENT     STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)        787.4 (31.0)     787.4 (31.0)     784.9 (30.9)     787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2U)      787.4 (31.0)     787.4 (31.0)     782.3 (30.8)     787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)     42.8 (109.0)     40.0 (104.0)     41.1 (106.0)     37.2 ( 99.0)
  BLOWER REVOLUTIONS                    40521.           69438.           40435.           69377.
  TOT FLOW STD. CU. METRES(SCF)         74.6 ( 2633.)   128.4 ( 4535.)    74.7 ( 2637.)   129.0 ( 4556.)
  THC SAMPLE METER/RANGE/PPM         22.5/  3/ 224.   27.0/  2/  27.   50.9/  2/  50.   27.0/  2/  27.
  THC BCKGRD METER/RANGE/PPM          1.2/  3/  12.   12.2/  2/  12.   12.1/  2/  12.   12.0/  2/  12.
  CO  SAMPLE METER/RANGE/PPM         69.2/  1/ 643.   44.2/ 12/  43.   62.3/ 14/ 287.   39.5/ 12/  39.
  CO  BCKGRD METER/RANGE/PPM           .1/  1/   1.     .6/ 12/   1.     .1/ 14/   0.     .4/ 12/   0.
  CO2 SAMPLE METER/RANGE/PCT         67.6/  1/1.2443  85.4/ 14/ .7639  97.5/ 14/1.0720  84.6/ 14/ .7473
  CO2 BCKGRD METER/RANGE/PCT          2.6/  1/ .0459  13.3/ 14/ .0450  13.5/ 14/ .0458  13.6/ 14/ .0462
  NOX SAMPLE METER/RANGE/PPM         47.2/  2/ 47.2   29.9/  2/ 29.9   62.7/  2/ 62.7   28.0/  2/ 28.1
  NOX BCKGRD METER/RANGE/PPM           .1/  2/   .1     .1/  2/   .1     .2/  2/   .2     .1/  2/   .1
  DILUTION FACTOR                        9.94            17.13            11.95            17.52
  THC CONCENTRATION PPM                 214.              15.              39.              16.
  CO  CONCENTRATION PPM                 615.              41.             275.              37.
  CO2 CONCENTRATION PCT                1.2030            .7215           1.0300            .7037
  NOX CONCENTRATION PPM                 47.1             29.9             62.5             28.0
  THC MASS GRAMS                         9.54             1.18             1.76             1.20
  CO  MASS GRAMS                        53.40             6.20            23.93             5.58
  CO2 MASS GRAMS                      1642.5           1696.6           1408.3           1662.4
  NOX MASS GRAMS                         6.21             6.78             8.25             6.38

  THC  GRAMS/MI                          2.72              .31              .50              .31
  CO   GRAMS/MI                         15.21             1.65             6.81             1.46
  CO2  GRAMS/MI                         467.7            450.2            400.9            436.1
  NOX  GRAMS/MI                          1.77             1.80             2.35             1.67
  FUEL ECONOMY IN MPG                   16.93    17.78   18.65            20.49    19.83   19.26
  RUN TIME             SECONDS          505.             867.             505.             868.
  MEASURED DISTANCE    MI               3.51     7.28    3.77             3.51     7.32    3.81
  SCF, DRY                              .970     .973    .975             .972     .974    .975
      DFC, WET (DRY)                          .926( .910)                       .933( .917)
      TOT VOL (SCM) / SAM BLR (SCM)           203.0/  .00                       203.7/  .00

MPOSITE RESULTS
 TEST NUMBER         342                                                         3-BAG     (4-BAG)
 BAROMETER    MM HG  736.3                  CARBON DIOXIDE       G/MI           440.3     ( 436.2)
 HUMIDITY     G/KG     8.2                  FUEL ECONOMY         MPG            18.72     ( 18.89)
 TEMPERATURE  DEG C   20.0                  HYDROCARBONS (THC)   G/MI             .86     (   .86)
                                            CARBON MONOXIDE      G/MI            5.88     (  5.82)
                                            OXIDES OF NITROGEN   G/MI            1.94     (  1.91)
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TABLE C-46

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          SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                        FTP   - VEHICLE EMISSIONS RESULTS -
                              PROJECT 06-2809-001

TEST NO.   343          RUN               VEHICLE NO.691                 TEST WEIGHT  1814. KG( 4000. LBS)
VEHICLE MODEL   83 BUICK REGAL            DATE    4/23/90                ACTUAL ROAD LOAD   8.4 KW( 11.3 HP)
ENGINE 3.8 L(232. CID) V-8                BAG CART NO. 2 / CVS NO.  2    GASOLINE  EM-908-F
TRANSMISSION A3                           DYNO NO.      3                ODOMETER 134231. KM( 83407. MILES)

BAROMETER 738.12 MM HG(29.06 IN HG)       DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  57. PCT                ABS. HUMIDITY  9.4 GM/KG       NOX HUMIDITY CORRECTION FACTOR   .96
BAG RESULTS
  BAG NUMBER                                   1                 2                  3                 4
  DESCRIPTION                            COLD TRANSIENT      STABILIZED       HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)          795.0 (31.3)      787.4 (31.0)      787.4 (31.0)      787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)        789.9 (31.1)      787.4 (31.0)      787.4 (31.0)      787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)       42.8 (109.0)      41.7 (107.0)      42.2 (108.0)      40.6 (105.0)
  BLOWER REVOLUTIONS                        40519.            69504.            40373.            69430.
  TOT FLOW STD. CU. METRES(SCF)           74.7 ( 2639.)    128.5 ( 4538.)     74.6 ( 2633.)    128.6 ( 4542.)
  THC SAMPLE METER/RANGE/PPM            16.5/   3/ 165.   29.4/   2/  29.   55.6/   2/  55.   28.5/   2/  28.
  THC BCKGRD METER/RANGE/PPM             1.4/   3/  14.   13.7/   2/  14.   13.7/   2/  14.   14.2/   2/  14.
  CO  SAMPLE METER/RANGE/PPM            67.3/   1/ 620.   41.3/  12/  41.   74.2/  14/ 353.   26.9/  12/  26.
  CO  BCKGRD METER/RANGE/PPM              .0/   1/   0.     .2/  12/   0.     .0/  14/   0.     .5/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT            70.7/   1/1.3026  85.4/  14/ .7639  97.2/  14/1.0627  84.6/  14/ .747
  CO2 BCKGRD METER/RANGE/PCT             2.5/   1/ .0441  13.0/  14/ .0438  13.2/  14/ .0446  13.2/  14/ .044
  NOX SAMPLE METER/RANGE/PPM            39.8/   2/ 39.8   29.9/   2/ 29.9   60.0/   2/ 60.0   28.8/   2/ 28.9
  NOX BCKGRD METER/RANGE/PPM              .1/   2/   .1     .0/   2/   .0     .2/   2/   .2     .1/   2/   .1
  DILUTION FACTOR                           9.58             17.13             11.98             17.54
  THC CONCENTRATION PPM                     152.              16.               43.               15.
  CO  CONCENTRATION PPM                     592.              39.               339.              25.
  CO2 CONCENTRATION PCT                    1.2631            .7226             1.0218            .7052
  NOX CONCENTRATION PPM                     39.7              29.9              59.8              28.8
  THC MASS GRAMS                            6.81              1.26              1.90              1.15
  CO  MASS GRAMS                           51.53              5.84             29.47              3.73
  CO2 MASS GRAMS                          1728.1            1700.1            1395.0            1660.7
  NOX MASS GRAMS                            5.45              7.06              8.18              6.78

  THC  GRAMS/MI                             1.92               .33               .54               .30
  CO   GRAMS/MI                            14.51              1.52              8.32               .97
  CO2  GRAMS/MI                            486.7             442.2             393.7             432.5
  NOX  GRAMS/MI                             1.53              1.84              2.31              1.77
  FUEL ECONOMY IN MPG                      16.42     17.67    18.99            20.72     20.05    19.46
  RUN TIME              SECONDS            505.              867.              504.              868.
  MEASURED DISTANCE     MI                 3.55      7.40     3.84             3.54      7.38     3.84
  SCF, DRY                                 .969      .972     .974             .971      .973     .974
      DFC, WET (DRY)                           .925( .908)                        .933( .916)
      TOT VOL (SCM) / SAM BLR (SCM)           203.2/   .00                       203.2/   .00

COMPOSITE RESULTS                                                                      3-BAG      (4-BA
  TEST NUMBER          343                        CARBON DIOXIDE         G/MI          438.1      ( 435.
  BAROMETER    MM HG  738.1                       FUEL ECONOMY           MPG           18.82      ( 18.9
  HUMIDITY     G/KG     9.4                       HYDROCARBONS (THC)     G/MI            .71      (   .7
  TEMPERATURE  DEG C   21.7                       CARBON MONOXIDE        G/MI           6.06      (  5.9
                                                  OXIDES OF NITROGEN     G/MI           1.90      (  1.8
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COMPUTER PRINTOUTS OF REGULATED EMISSIONS AND FUEL ECONOMY FROM TEST VEHICLE 1, A 1990 CHEVROLET LUMINA

Test Fuel	Test No.	Table C-
Baseline (EM-905-F)	111	47
	112	48
	113	49
	114	50
	115	51
	116	52
10% Ethanol (EM-906-F)	121	53
	122	54
	123	55
16.4% MTBE (EM-907-F)	131	56
	132	57
	133	58
19.1% ETBE (EM-908-F)	141	59
	142	60
	143	61

TABLE C-47

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                 FTP   - VEHICLE EMISSIONS RESULTS -
                                      PROJECT 08-2809-001

TEST NO.   111          RUN   1                VEHICLE NO.83                      TEST WEIGHT  1588. KG( 3500. LBS)
VEHICLE MODEL   90 CHEV. LUMINA                DATE    2/ 7/90                    ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
ENGINE 2.5 L(153. CID) L-4                     BAG CART NO. 2 / CVS NO.  2        GASOLINE  EM-905-F
TRANSMISSION A3                                DYNO NO.      3                    ODOMETER   8525. KM(  5297. MILES)

BAROMETER 746.00 MM HG(29.37 IN HG)            DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  35. PCT                     ABS. HUMIDITY  6.8 GM/KG           NOX HUMIDITY CORRECTION FACTOR   .89
BAG RESULTS
   BAG NUMBER                                       1                 2                 3                 4
   DESCRIPTION                                COLD TRANSIENT     STABILIZED       HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)               731.5 (28.8)      731.5 (28.8)      731.5 (28.8)      729.0 (28.7)
   BLOWER INLET P MM. H2O(IN. H2O)             729.0 (28.7)      729.0 (28.7)      729.0 (28.7)      723.9 (28.5)
   BLOWER INLET TEMP. DEG. C(DEG. F)            42.8 (109.0)      40.6 (105.0)      42.8 (109.0)      41.7 (107.0)
   BLOWER REVOLUTIONS                            40540.            69702.            40514.            69510.
   TOT FLOW STD. CU. METRES(SCF)                76.3 ( 2696.)    131.8 ( 4653.)     76.3 ( 2694.)    131.2 ( 4634.)
   THC SAMPLE METER/RANGE/PPM                56.1/  2/  56.    10.2/  2/  10.    15.9/  2/  16.    10.0/  2/  10.
   THC BCKGRD METER/RANGE/PPM                 8.0/  2/   8.     9.1/  2/   9.     8.7/  2/   9.     8.5/  2/   8.
   CO  SAMPLE METER/RANGE/PPM                69.6/ 14/ 327.    24.4/ 12/  24.    88.1/ 12/  88.    37.2/ 12/  36.
   CO  BCKGRD METER/RANGE/PPM                  .5/ 14/   2.     1.5/ 12/   1.     1.3/ 12/   1.      .9/ 12/   1.
   CO2 SAMPLE METER/RANGE/PCT                58.4/  1/1.0718   79.9/ 14/ .6571   92.1/ 14/ .9193   78.0/ 14/ .6376
   CO2 BCKGRD METER/RANGE/PCT                 2.8/  1/ .0494   13.9/ 14/ .0474   13.6/ 14/ .0462   13.8/ 14/ .0470
   NOX SAMPLE METER/RANGE/PPM                52.8/  1/ 13.2    10.0/  1/  2.6    31.8/  1/  8.0    10.7/  1/  2.8
   NOX BCKGRD METER/RANGE/PPM                  .5/  1/   .1      .3/  1/   .1      .3/  1/   .1      .3/  1/   .1
   DILUTION FACTOR                                12.26             20.59             14.63             21.17
   THC CONCENTRATION PPM                          48.                2.                8.                2.
   CO  CONCENTRATION PPM                          315.              22.               85.               35.
   CO2 CONCENTRATION PCT                          1.0264            .6120             .8763             .5928
   NOX CONCENTRATION PPM                          13.1               2.5               7.9               2.7
   THC MASS GRAMS                                 2.11               .12               .34               .14
   CO  MASS GRAMS                                 28.00              3.35              7.51              5.32
   CO2 MASS GRAMS                                 1434.7            1476.6            1223.9            1424.2
   NOX MASS GRAMS                                 1.70               .56              1.03               .60

   THC  GRAMS/MI                                   .59               .03               .09               .04
   CO   GRAMS/MI                                  7.84               .87              2.10              1.39
   CO2  GRAMS/MI                                  401.8             382.3             342.8             371.8
   NOX  GRAMS/MI                                   .48               .15               .29               .16
   FUEL ECONOMY IN MPG                            21.77     22.69    23.60            26.15     25.11   24.21
   RUN TIME               SECONDS                 506.               869.              505.              867.
   MEASURED DISTANCE      MI                      3.57      7.43     3.86             3.57      7.40    3.83
   SCF, DRY                                       .979      .981     .983             .980      .982    .983
        DFC, WET (DRY)                                 .939( .929)                         .945( .934)
        TOT VOL (SCM) / SAM BLR (SCM)                  208.1/  .00                         207.5/  .00

COMPOSITE RESULTS                                                                                 3-BAG      (4-BAG)
   TEST NUMBER          111                                    CARBON DIOXIDE        G/MI         375.5      ( 372.4)
   BAROMETER     MM HG  746.0                                  FUEL ECONOMY          MPG          23.82      ( 24.01)
   HUMIDITY      G/KG     6.8                                  HYDROCARBONS (THC)    G/MI           .16      (   .17
   TEMPERATURE   DEG C   24.4                                  CARBON MONOXIDE       G/MI          2.65      (  2.80
                                                               OXIDES OF NITROGEN    G/MI           .25      (   .26
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TABLE C-48

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                          FTP   - VEHICLE EMISSIONS RESULTS -
                                PROJECT 08-2809-001

TEST NO.   112          RUN   1
VEHICLE MODEL   90 CHEV. LUMINA            VEHICLE NO.83                    TEST WEIGHT  1588. KG( 3500. LBS)
ENGINE 2.5 L(153. CID) L-4                 DATE    2/ 8/90                  ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
TRANSMISSION A3                            BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-905-F
                                           DYNO NO.     3                   ODOMETER   8560. KM(  5319. MILES)

BAROMETER 741.93 MM HG(29.21 IN HG)        DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  45. PCT                 ABS. HUMIDITY  8.8 GM/KG         NOX HUMIDITY CORRECTION FACTOR   .94
BAG RESULTS
   BAG NUMBER                                    1                 2                 3                 4
   DESCRIPTION                            COLD TRANSIENT      STABILIZED       HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)           723.9 (28.5)      723.9 (28.5)      729.0 (28.7)      718.8 (28.3)
   BLOWER INLET P MM. H2O(IN. H2O)         718.8 (28.3)      718.8 (28.3)      723.9 (28.5)      713.7 (28.1)
   BLOWER INLET TEMP. DEG. C(DEG. F)        41.7 (107.0)      41.7 (107.0)      42.2 (108.0)      41.7 (107.0)
   BLOWER REVOLUTIONS                        40585.            69536.            40582.            69533.
   TOT FLOW STD. CU. METRES(SCF)           76.1 ( 2686.)    130.6 ( 4611.)     75.9 ( 2681.)    130.7 ( 4614.)
   THC SAMPLE METER/RANGE/PPM            71.2/  2/  70.    10.6/  2/  10.    15.0/  2/  15.    10.5/  2/  10.
   THC BCKGRD METER/RANGE/PPM             8.5/  2/   8.     9.6/  2/   9.     9.0/  2/   9.     9.1/  2/   9.
   CO  SAMPLE METER/RANGE/PPM            71.1/ 14/ 336.    21.1/ 12/  20.    55.0/ 12/  54.    25.9/ 12/  25.
   CO  BCKGRD METER/RANGE/PPM              .0/ 14/   0.      .0/ 12/   0.      .0/ 12/   0.      .0/ 12/   0.
   CO2 SAMPLE METER/RANGE/PCT            59.2/  1/1.0868   80.1/ 14/ .6607   92.3/ 14/ .9245   78.9/ 14/ .6393
   CO2 BCKGRD METER/RANGE/PCT             2.6/  1/ .0459   12.6/ 14/ .0422   12.4/ 14/ .0415   12.5/ 14/ .0418
   NOX SAMPLE METER/RANGE/PPM            42.5/  1/ 10.7     8.8/  1/  2.3    28.6/  1/  7.2    10.9/  1/  2.8
   NOX BCKGRD METER/RANGE/PPM              .0/  1/   .0      .0/  1/   .0      .0/  1/   .0      .5/  1/   .1
   DILUTION FACTOR                            12.07             20.48             14.60             21.15
   THC CONCENTRATION PPM                      63.               1.                7.                2.
   CO  CONCENTRATION PPM                      324.              20.               53.               25.
   CO2 CONCENTRATION PCT                      1.0447            .6205             .8859             .5995
   NOX CONCENTRATION PPM                      10.7              2.3               7.2               2.7
   THC MASS GRAMS                             2.74              .11               .29               .14
   CO  MASS GRAMS                             28.68             3.03              4.64              3.73
   CO2 MASS GRAMS                             1454.9            1483.5            1231.4            1434.1
   NOX MASS GRAMS                             1.46              .54               .99               .63

   THC  GRAMS/MI                              .76               .03               .08               .04
   CO   GRAMS/MI                              8.00              .78               1.30              .97
   CO2  GRAMS/MI                              405.6             383.8             343.8             372.2
   NOX  GRAMS/MI                              .41               .14               .28               .16
   FUEL ECONOMY IN MPG                        21.54     22.52   23.52             26.17     25.13   24.23
   RUN TIME             SECONDS               505.              867.              505.              867.
   MEASURED DISTANCE    MI                    3.59      7.45    3.87              3.58      7.43    3.85
   SCF, DRY                                   .976      .978    .980              .977      .979    .980
        DFC, WET (DRY)                              .939( .925)                         .945( .931;
        TOT VOL (SCM) / SAM BLR (SCM)               206.6/  .00                         206.6/  .00

COMPOSITE RESULTS
   TEST NUMBER          112                                                          3-BAG      (4-BAG)
   BAROMETER    MM HG  741.9                     CARBON DIOXIDE         G/MI         377.4      ( 373.9)
   HUMIDITY     G/KG     8.8                     FUEL ECONOMY           MPG          23.73      ( 23.94)
   TEMPERATURE  DEG C   24.4                     HYDROCARBONS (THC)     G/MI           .19      (   .20)
                                                 CARBON MONOXIDE        G/MI          2.42      (  2.47)
                                                 OXIDES OF NITROGEN     G/MI           .23      (   .24)
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TABLE C-49

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                FTP   - VEHICLE EMISSIONS RESULTS -
                                      PROJECT 08-2809-001

TEST NO.   113          RUN  1           VEHICLE NO.83                    TEST WEIGHT  1588. KG( 3500. LBS)
.EHICLE MODEL   90 CHEV. LUMINA          DATE    2/16/90                  ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
ENGINE 2.5 L(153. CID) L-4               BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-905-F
TRANSMISSION A3                          DYNO NO.      3                  ODOMETER   8756. KM(  5441. MILES)

BAROMETER 746.00 MM HG(29.37 IN HG)      DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
RELATIVE HUMIDITY  19. PCT               ABS. HUMIDITY  3.2 GM/KG         NOX HUMIDITY CORRECTION FACTOR   .80
BAG RESULTS
  BAG NUMBER                                  1                  2                  3                  4
  DESCRIPTION                          COLD TRANSIENT       STABILIZED       HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)         749.3 (29.5)       756.9 (29.8)       756.9 (29.8)       756.9 (29.8)
  BLOWER INLET P MM. H2O(IN. H2O)       749.3 (29.5)       756.9 (29.8)       756.9 (29.8)       756.9 (29.8)
  BLOWER INLET TEMP. DEG. C(DEG. F)      40.6 (105.0)       38.3 (101.0)       39.4 (103.0)       41.7 (107.0)
  BLOWER REVOLUTIONS                       40614.             69473.             40518.             69611.
  TOT FLOW STD. CU. METRES(SCF)         76.6 ( 2704.)      131.4 ( 4640.)      76.5 ( 2700.)      130.8 ( 4619.)
  THC SAMPLE METER/RANGE/PPM          72.1/  2/  71.      9.1/  2/   9.     11.5/  2/  11.      8.2/  2/   8.
  THC BCKGRD METER/RANGE/PPM           6.9/  2/   7.      7.2/  2/   7.      5.8/  2/   6.      5.8/  2/   6.
  CO  SAMPLE METER/RANGE/PPM          61.0/ 14/ 280.     19.5/ 12/  19.     51.0/ 12/  50.     26.8/ 12/  26.
  CO  BCKGRD METER/RANGE/PPM            .0/ 14/   0.       .0/ 12/   0.       .0/ 12/   0.       .0/ 12/   0.
  CO2 SAMPLE METER/RANGE/PCT          57.5/  1/1.0550    78.9/ 14/ .6393    91.6/ 14/ .9066    78.0/ 14/ .6237
  CO2 BCKGRD METER/RANGE/PCT           2.2/  1/ .0388    12.1/ 14/ .0403    12.3/ 14/ .0411    12.4/ 14/ .0415
  NOX SAMPLE METER/RANGE/PPM          72.9/  1/ 18.3     11.9/  1/  3.1     39.5/  1/  9.9     11.9/  1/  3.1
  NOX BCKGRD METER/RANGE/PPM            .0/  1/   .0       .0/  1/   .0       .0/  1/   .0       .0/  1/   .0
  DILUTION FACTOR                          12.48              21.17              14.90              21.68
  THC CONCENTRATION PPM                    65.                2.                 6.                 3.
  CO  CONCENTRATION PPM                    272.               19.                49.                26.
  CO2 CONCENTRATION PCT                    1.0193             .6009              .8683              .5842
  NOX CONCENTRATION PPM                    18.3               3.1                9.9                3.1
  THC MASS GRAMS                           2.86               .17                .26                .20
  CO  MASS GRAMS                           24.29              2.84               4.37               3.91
  CO2 MASS GRAMS                           1428.9             1445.6             1215.5             1399.1
  NOX MASS GRAMS                           2.14               .62                1.16               .62

  THC  GRAMS/MI                            .80                .04                .07                .05
  CO   GRAMS/MI                            6.77               .74                1.23               1.01
  CO2  GRAMS/MI                            398.1              374.8              341.7              362.5
  NOX  GRAMS/MI                            .60                .16                .33                .16
  FUEL ECONOMY IN MPG                      22.02     23.04    24.08              26.35     25.56    24.87
  RUN TIME               SECONDS           506.               867.               505.               868.
  MEASURED DISTANCE      MI                3.59      7.45     3.86               3.56      7.42     3.86
  SCF, DRY                                 .985      .987     .988               .986      .987     .988
      DFC, WET (DRY)                             .941( .935)                           .946( .940)
      TOT VOL (SCM) / SAM BLR (SCM)              208.0/   .00                          207.3/   .00

COMPOSITE RESULTS
  TEST NUMBER          113                                                         3-BAG       (4-BA
  BAROMETER    MM HG  746.0                  CARBON DIOXIDE         G/MI          370.6       ( 366.
  HUMIDITY     G/KG     3.2                  FUEL ECONOMY           MPG           24.18       ( 24.4
  TEMPERATURE  DEG C   22.2                  HYDROCARBONS (THC)     G/MI            .21       (   .2
                                             CARBON MONOXIDE        G/MI           2.12       (  2.2
                                             OXIDES OF NITROGEN     G/MI            .30       (   .3
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TABLE C-50

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 114 RUN 1
VEHICLE MODEL 90 CHEV. LUMINA
ENGINE 2.5 L(153. CID) L-4
TRANSMISSION A3

VEHICLE NO.83
DATE 2/27/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 1588. KG(3500. LBS)
ACTUAL ROAD LOAD 4.2 KW(5.6 HP)
GASOLINE EM-905-F
ODOMETER 8991. KM(5587. MILES)

BAROMETER 747.52 MM HG(29.43 IN HG)
RELATIVE HUMIDITY 60. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 12.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.05

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	764.5 (30.1)		774.7 (30.5)	774.7 (30.5)		772.2 (30.4)
BLOWER INLET P MM. H2O(IN. H2O)	762.0 (30.0)		769.6 (30.3)	769.6 (30.3)		767.1 (30.2)
BLOWER INLET TEMP. DEG. C(DEG. F)	42.8 (109.0)		43.3 (110.0)	42.8 (109.0)		43.3 (110.0)
BLOWER REVOLUTIONS	40481.		69437.	40443.		69494.
TOT FLOW STD. CU. METRES(SCF)	76.0 (2685.)		130.1 (4595.)	75.9 (2679.)		130.3 (4600.)
THC SAMPLE METER/RANGE/PPM	65.9/ 2/ 65.		10.6/ 2/ 10.	16.1/ 2/ 16.		10.4/ 2/ 10.
THC BCKGRD METER/RANGE/PPM	8.5/ 2/ 8.		8.7/ 2/ 9.	8.5/ 2/ 8.		7.5/ 2/ 7.
CO SAMPLE METER/RANGE/PPM	63.7/ 14/ 294.		28.3/ 12/ 28.	46.6/ 13/ 109.		43.4/ 12/ 43.
CO BCKGRD METER/RANGE/PPM	.1/ 14/ 0.		.1/ 12/ 0.	.1/ 13/ 0.		.3/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	96.5/ 14/1.0415		79.2/ 14/ .6446	92.2/ 14/ .9219		78.7/ 14/ .6358
CO2 BCKGRD METER/RANGE/PCT	12.9/ 14/ .0434		12.8/ 14/ .0430	12.6/ 14/ .0422		12.7/ 14/ .0426
NOX SAMPLE METER/RANGE/PPM	51.0/ 1/ 12.8		8.9/ 1/ 2.3	28.2/ 1/ 7.1		10.0/ 1/ 2.6
NOX BCKGRD METER/RANGE/PPM	.1/ 1/ .0		.2/ 1/ .1	.1/ 1/ .0		.5/ 1/ .1
DILUTION FACTOR	12.63		20.97	14.56		21.21
THC CONCENTRATION PPM	57.		2.	8.		3.
CO CONCENTRATION PPM	283.		27.	104.		41.
CO2 CONCENTRATION PCT	1.0015		.6036	.8826		.5952
NOX CONCENTRATION PPM	12.8		2.3	7.1		2.5
THC MASS GRAMS	2.51		.17	.35		.24
CO MASS GRAMS	25.01		4.04	9.22		6.23
CO2 MASS GRAMS	1394.0		1438.0	1225.8		1419.6
NOX MASS GRAMS	1.94		.59	1.08		.64
THC GRAMS/MI	.70		.04	.10		.06
CO GRAMS/MI	7.00		1.06	2.59		1.56
CO2 GRAMS/MI	390.0		376.4	343.8		356.6
NOX GRAMS/MI	.54		.15	.30		.16
FUEL ECONOMY IN MPG	22.46	23.21	23.95	26.02	25.59	25.21
RUN TIME SECONDS	505.		867.	505.		868.
MEASURED DISTANCE MI	3.57	7.40	3.82	3.57	7.55	3.98
SCF, DRY	.972	.974	.975	.973	.974	.975
DFC, WET (DRY)		.941(.923)			.945(.927)	
TOT VOL (SCM) / SAM BLR (SCM)		206.1/ .00			206.1/ .00	

COMPOSITE RESULTS

TEST NUMBER 114
BAROMETER MM HG 747.5
HUMIDITY G/KG 12.0
TEMPERATURE DEG C 25.0

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	370.2	(364.5)
FUEL ECONOMY	MPG	24.15	(24.51)
HYDROCARBONS (THC)	G/MI	.20	(.20)
CARBON MONOXIDE	G/MI	2.71	(2.86)
OXIDES OF NITROGEN	G/MI	.28	(.28)

TABLE C-51

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 115 RUN 1
VEHICLE MODEL 90 CHEV. LUMINA
ENGINE 2.5 L(153. CID) L-4
TRANSMISSION A3

VEHICLE NO.83
DATE 3/ 5/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 1588. KG(3500. LBS)
ACTUAL ROAD LOAD 4.2 KW(5.6 HP)
GASOLINE EM-905-F
ODOMETER 9194. KM(5713. MILES)

BAROMETER 739.39 MM HG(29.11 IN HG)
RELATIVE HUMIDITY 53. PCT

DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
ABS. HUMIDITY 10.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.00

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	762.0 (30.0)		764.5 (30.1)	764.5 (30.1)		764.5 (30.1)
BLOWER INLET P MM. H2O(IN. H2O)	762.0 (30.0)		762.0 (30.0)	762.0 (30.0)		762.0 (30.0)
BLOWER INLET TEMP. DEG. C(DEG. F)	44.4 (112.0)		43.3 (110.0)	45.0 (113.0)		43.3 (110.0)
BLOWER REVOLUTIONS	40438.		69402.	40423.		69492.
TOT FLOW STD. CU. METRES(SCF)	74.8 (2642.)		128.6 (4542.)	74.8 (2642.)		128.8 (4548.)
THC SAMPLE METER/RANGE/PPM	66.7/ 2/ 66.		11.3/ 2/ 11.	15.3/ 2/ 15.		10.5/ 2/ 10.
THC BCKGRD METER/RANGE/PPM	8.7/ 2/ 9.		10.0/ 2/ 10.	9.1/ 2/ 9.		8.7/ 2/ 9.
CO SAMPLE METER/RANGE/PPM	64.6/ 14/ 299.		35.2/ 12/ 34.	88.4/ 12/ 89.		38.2/ 12/ 37.
CO BCKGRD METER/RANGE/PPM	.3/ 14/ 1.		1.0/ 12/ 1.	.6/ 12/ 1.		3.5/ 12/ 3.
CO2 SAMPLE METER/RANGE/PCT	58.1/ 1/1.0662		79.7/ 14/ .6535	92.6/ 14/ .9323		78.9/ 14/ .6393
CO2 BCKGRD METER/RANGE/PCT	2.6/ 1/ .0459		13.2/ 14/ .0446	12.9/ 14/ .0434		13.4/ 14/ .0454
NOX SAMPLE METER/RANGE/PPM	49.3/ 1/ 12.4		8.1/ 1/ 2.1	31.1/ 1/ 7.9		8.8/ 1/ 2.3
NOX BCKGRD METER/RANGE/PPM	.0/ 1/ .0		.0/ 1/ .0	.0/ 1/ .0		.6/ 1/ .2
DILUTION FACTOR	12.34		20.66	14.43		21.11
THC CONCENTRATION PPM	58.		2.	7.		2.
CO CONCENTRATION PPM	287.		33.	85.		33.
CO2 CONCENTRATION PCT	1.0240		.6111	.8919		.5961
NOX CONCENTRATION PPM	12.4		2.1	7.9		2.1
THC MASS GRAMS	2.49		.13	.29		.16
CO MASS GRAMS	25.01		4.88	7.41		4.98
CO2 MASS GRAMS	1402.7		1439.1	1221.9		1405.7
NOX MASS GRAMS	1.77		.52	1.12		.53
THC GRAMS/MI	.70		.03	.08		.04
CO GRAMS/MI	6.98		1.28	2.07		1.30
CO2 GRAMS/MI	391.3		377.3	341.2		367.4
NOX GRAMS/MI	.49		.14	.31		.14
FUEL ECONOMY IN MPG	22.39	23.13	23.87	26.27	25.33	24.51
RUN TIME SECONDS	505.		867.	505.		867.
MEASURED DISTANCE MI	3.58	7.40	3.81	3.58	7.41	3.83
SCF, DRY	.974	.976	.977	.975	.976	.977
DFC, WET (DRY)		.940(.924)			.945(.929)	
TOT VOL (SCM) / SAM BLR (SCM)		203.4/ .00			203.6/ .00	

COMPOSITE RESULTS

TEST NUMBER		115
BAROMETER	MM HG	739.4
HUMIDITY	G/KG	10.7
TEMPERATURE	DEG C	25.0

		3-BAG	(4-BA
CARBON DIOXIDE	G/MI	370.3	(367.
FUEL ECONOMY	MPG	24.15	(24.3
HYDROCARBONS (THC)	G/MI	.18	(.1
CARBON MONOXIDE	G/MI	2.68	(2.6
OXIDES OF NITROGEN	G/MI	.26	(.2

TABLE C-52

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 116 RUN 1
VEHICLE MODEL 90 CHEV. LUMINA
ENGINE 2.5 L(153. CID) L-4
TRANSMISSION A3

VEHICLE NO.83
DATE 3/ 6/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 1588. KG(3500. LBS)
ACTUAL ROAD LOAD 4.2 KW(5.6 HP)
GASOLINE EM-905-F
ODOMETER 9225. KM(5732. MILES)

BAROMETER 737.11 MM HG(29.02 IN HG)
RELATIVE HUMIDITY 57. PCT

DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
ABS. HUMIDITY 12.0 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.04

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	762.0 (30.0)		762.0 (30.0)	764.5 (30.1)		764.5 (30.1)
BLOWER INLET P MM. H2O(IN. H2O)	762.0 (30.0)		762.0 (30.0)	762.0 (30.0)		762.0 (30.0)
BLOWER INLET TEMP. DEG. C(DEG. F)	42.8 (109.0)		41.7 (107.0)	42.8 (109.0)		43.3 (110.0)
BLOWER REVOLUTIONS	40482.		69491.	40449.		69605.
TOT FLOW STD. CU. METRES(SCF)	74.9 (2643.)		128.8 (4547.)	74.8 (2641.)		128.6 (4540.)
THC SAMPLE METER/RANGE/PPM	69.3/ 2/ 69.		12.0/ 2/ 12.	16.8/ 2/ 17.		14.1/ 2/ 14.
THC BCKGRD METER/RANGE/PPM	9.2/ 2/ 9.		10.5/ 2/ 10.	10.9/ 2/ 11.		11.9/ 2/ 12.
CO SAMPLE METER/RANGE/PPM	66.1/ 14/ 308.		33.2/ 12/ 32.	46.7/ 13/ 109.		56.2/ 12/ 55.
CO BCKGRD METER/RANGE/PPM	.1/ 14/ 0.		.4/ 12/ 0.	.3/ 13/ 1.		1.9/ 12/ 2.
CO2 SAMPLE METER/RANGE/PCT	60.3/ 1/1.1074		80.4/ 14/ .6661	93.1/ 14/ .9455		79.6/ 14/ .6517
CO2 BCKGRD METER/RANGE/PCT	2.7/ 1/ .0476		13.1/ 14/ .0442	13.3/ 14/ .0450		13.6/ 14/ .0462
NOX SAMPLE METER/RANGE/PPM	41.4/ 1/ 10.4		6.5/ 1/ 1.7	25.5/ 1/ 6.5		10.2/ 1/ 2.6
NOX BCKGRD METER/RANGE/PPM	.3/ 1/ .1		.0/ 1/ .0	.0/ 1/ .0		.3/ 1/ .1
DILUTION FACTOR	11.89		20.28	14.20		20.65
THC CONCENTRATION PPM	60.		2.	7.		3.
CO CONCENTRATION PPM	295.		31.	104.		52.
CO2 CONCENTRATION PCT	1.0637		.6241	.9037		.6078
NOX CONCENTRATION PPM	10.3		1.7	6.5		2.6
THC MASS GRAMS	2.59		.15	.28		.20
CO MASS GRAMS	25.73		4.66	9.08		7.80
CO2 MASS GRAMS	1457.9		1471.3	1237.4		1430.7
NOX MASS GRAMS	1.54		.44	.97		.66
THC GRAMS/MI	.72		.04	.08		.05
CO GRAMS/MI	7.19		1.21	2.53		2.02
CO2 GRAMS/MI	407.6		383.1	345.3		370.2
NOX GRAMS/MI	.43		.11	.27		.17
FUEL ECONOMY IN MPG	21.50	22.50	23.52	25.91	25.02	24.25
RUN TIME SECONDS	505.		867.	505.		868.
MEASURED DISTANCE MI	3.58	7.42	3.84	3.58	7.45	3.86
SCF, DRY	.972	.974	.976	.973	.975	.976
DFC, WET (DRY)		.938(.921)			.943(.926)	
TOT VOL (SCM) / SAM BLR (SCM)		203.6/ .00			203.4/ .00	

COMPOSITE RESULTS

TEST NUMBER		116
BAROMETER	MM HG	737.1
HUMIDITY	G/KG	12.0
TEMPERATURE	DEG C	25.6

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	377.8	(374.0)
FUEL ECONOMY	MPG	23.66	(23.87)
HYDROCARBONS (THC)	G/MI	.19	(.20)
CARBON MONOXIDE	G/MI	2.82	(3.05)
OXIDES OF NITROGEN	G/MI	.22	(.24)

TABLE C-53

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                               FTP   - VEHICLE EMISSIONS RESULTS -
                                   PROJECT 08-2809-001

TEST NO.   121          RUN   1            VEHICLE NO.83                        TEST WEIGHT  1588. KG( 3500. LBS)
VEHICLE MODEL   90 CHEV. LUMINA            DATE    2/13/90                      ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
ENGINE 2.5 L(153. CID) L-4                 BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-906-F
TRANSMISSION A3                            DYNO NO.       3                     ODOMETER   8629. KM(  5362. MILES)

BAROMETER 739.39 MM HG(29.11 IN HG)        DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  54. PCT                 ABS. HUMIDITY 10.0 GM/KG             NOX HUMIDITY CORRECTION FACTOR   .98
BAG RESULTS
  BAG NUMBER                                   1                2                3                4
  DESCRIPTION                            COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)           723.9 (28.5)     729.0 (28.7)     729.0 (28.7)     731.5 (28.8)
  BLOWER INLET P MM. H2O(IN. H2O)         718.8 (28.3)     723.9 (28.5)     723.9 (28.5)     723.9 (28.5)
  BLOWER INLET TEMP. DEG. C(DEG. F)        41.7 (107.0)     41.1 (106.0)     42.2 (108.0)     41.7 (107.0)
  BLOWER REVOLUTIONS                         40528.           69579.           40515.           69529.
  TOT FLOW STD. CU. METRES(SCF)            75.8 ( 2677.)   130.2 ( 4598.)    75.7 ( 2672.)   130.0 ( 4589.)
  THC SAMPLE METER/RANGE/PPM             50.8/  2/  50.   12.1/  2/  12.   14.9/  2/  15.   10.4/  2/  10.
  THC BCKGRD METER/RANGE/PPM             10.4/  2/  10.   11.4/  2/  11.   10.1/  2/  10.    8.7/  2/   9.
  CO  SAMPLE METER/RANGE/PPM             53.9/ 14/ 242.   19.6/ 12/  19.   69.4/ 12/  69.   22.2/ 12/  22.
  CO  BCKGRD METER/RANGE/PPM               .2/ 14/   1.     .0/ 12/   0.     .0/ 12/   0.     .0/ 12/   0.
  CO2 SAMPLE METER/RANGE/PCT             57.5/  1/1.0550  79.3/ 14/ .6464  91.8/ 14/ .9116  78.2/ 14/ .6272
  CO2 BCKGRD METER/RANGE/PCT              2.7/  1/ .0476  12.9/ 14/ .0434  12.9/ 14/ .0434  13.0/ 14/ .0438
  NOX SAMPLE METER/RANGE/PPM             43.9/  1/ 11.0    9.1/  1/  2.4   31.4/  1/  7.9   11.7/  1/  3.0
  NOX BCKGRD METER/RANGE/PPM               .1/  1/   .0     .1/  1/   .0     .1/  1/   .0     .3/  1/   .1
  DILUTION FACTOR                             12.27            20.48            14.46            21.10
  THC CONCENTRATION PPM                       41.               1.               5.               2.
  CO  CONCENTRATION PPM                       232.              18.              66.              21.
  CO2 CONCENTRATION PCT                       1.0112           .6051            .8712            .5854
  NOX CONCENTRATION PPM                       11.0              2.3              7.9              2.9
  THC MASS GRAMS                              1.86              .10              .25              .16
  CO  MASS GRAMS                             20.49             2.79             5.85             3.16
  CO2 MASS GRAMS                            1403.8           1442.4           1206.9           1393.0
  NOX MASS GRAMS                              1.56              .57             1.12              .72

  THC  GRAMS/MI                                .52              .03              .07              .04
  CO   GRAMS/MI                               5.73              .72             1.63              .83
  CO2  GRAMS/MI                              392.6            373.9            337.0            364.2
  NOX  GRAMS/MI                                .44              .15              .31              .19
  FUEL ECONOMY IN MPG                       21.07     21.87    22.65            25.01    24.06    23.24
  RUN TIME            SECONDS               505.               868.             505.               867.
  MEASURED DISTANCE    MI                   3.58      7.43     3.86             3.58     7.41     3.82
  SCF, DRY                                  .972      .975     .976             .974     .975     .976
      DFC, WET (DRY)                              .939( .923)                         .945( .928)
      TOT VOL (SCM) / SAM BLR (SCM)              206.0/   .00                        205.6/   .00

COMPOSITE RESULTS                                                                        3-BAG       (4-BAG
  TEST NUMBER         121                                CARBON DIOXIDE       G/MI       367.6      ( 364.7
  BAROMETER    MM HG  739.4                              FUEL ECONOMY         MPG        22.89      ( 23.07
  HUMIDITY     G/KG    10.0                              HYDROCARBONS (THC)   G/MI         .14      (   .14
  TEMPERATURE  DEG C   23.3                              CARBON MONOXIDE      G/MI        2.01      (  2.04
                                                         OXIDES OF NITROGEN   G/MI         .25      (   .26
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TABLE C-54

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 122 RUN 1
VEHICLE MODEL 90 CHEV. LUMINA
ENGINE 2.5 L(153. CID) L-4
TRANSMISSION A3

VEHICLE NO.83
DATE 2/14/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 1588. KG(3500. LBS)
ACTUAL ROAD LOAD 4.2 KW(5.6 HP)
GASOLINE EM-906-F
ODOMETER 8660. KM(5381. MILES)

BAROMETER 735.33 MM HG(28.95 IN HG)
RELATIVE HUMIDITY 52. PCT

DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
ABS. HUMIDITY 10.3 GM/KG

NOX HUMIDITY CORRECTION FACTOR .99

BAG RESULTS

BAG NUMBER DESCRIPTION	1 COLD TRANSIENT		2 STABILIZED	3 HOT TRANSIENT		4 STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	723.9 (28.5)		723.9 (28.5)	723.9 (28.5)		723.9 (28.5)
BLOWER INLET P MM. H2O(IN. H2O)	723.9 (28.5)		723.9 (28.5)	723.9 (28.5)		723.9 (28.5)
BLOWER INLET TEMP. DEG. C(DEG. F)	41.7 (107.0)		40.6 (105.0)	42.2 (108.0)		40.6 (105.0)
BLOWER REVOLUTIONS	40474.		69500.	40480.		69500.
TOT FLOW STD. CU. METRES(SCF)	75.2 (2656.)		129.4 (4570.)	75.1 (2654.)		129.4 (4571.)
THC SAMPLE METER/RANGE/PPM	54.6/ 2/ 54.		13.6/ 2/ 13.	16.5/ 2/ 16.		10.9/ 2/ 11.
THC BCKGRD METER/RANGE/PPM	12.4/ 2/ 12.		13.3/ 2/ 13.	11.5/ 2/ 11.		9.2/ 2/ 9.
CO SAMPLE METER/RANGE/PPM	88.5/ 13/ 217.		18.3/ 12/ 18.	80.7/ 12/ 81.		24.4/ 12/ 24.
CO BCKGRD METER/RANGE/PPM	.2/ 13/ 0.		.4/ 12/ 0.	.3/ 12/ 0.		.1/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	57.1/ 1/1.0475		79.0/ 14/ .6411	91.6/ 14/ .9066		78.4/ 14/ .6306
CO2 BCKGRD METER/RANGE/PCT	2.8/ 1/ .0494		13.7/ 14/ .0466	13.4/ 14/ .0454		12.9/ 14/ .0434
NOX SAMPLE METER/RANGE/PPM	45.7/ 1/ 11.5		11.5/ 1/ 3.0	30.0/ 1/ 7.6		11.1/ 1/ 2.9
NOX BCKGRD METER/RANGE/PPM	.5/ 1/ .1		.6/ 1/ .2	.4/ 1/ .1		.1/ 1/ .0
DILUTION FACTOR	12.38		20.64	14.52		20.97
THC CONCENTRATION PPM	43.		1.	6.		2.
CO CONCENTRATION PPM	209.		17.	77.		23.
CO2 CONCENTRATION PCT	1.0021		.5967	.8643		.5893
NOX CONCENTRATION PPM	11.3		2.8	7.5		2.8
THC MASS GRAMS	1.93		.07	.26		.16
CO MASS GRAMS	18.26		2.54	6.78		3.46
CO2 MASS GRAMS	1379.9		1414.0	1189.2		1396.5
NOX MASS GRAMS	1.61		.69	1.06		.70
THC GRAMS/MI	.54		.02	.07		.04
CO GRAMS/MI	5.12		.66	1.90		.91
CO2 GRAMS/MI	387.1		368.6	334.1		365.5
NOX GRAMS/MI	.45		.18	.30		.18
FUEL ECONOMY IN MPG	21.41	22.20	22.98	25.19	24.09	23.15
RUN TIME SECONDS	505.		867.	505.		867.
MEASURED DISTANCE MI	3.56	7.40	3.84	3.56	7.38	3.82
SCF, DRY	.973	.976	.977	.974	.976	.977
DFC, WET (DRY)		.940(.924)			.945(.929)	
TOT VOL (SCM) / SAM BLR (SCM)		204.6/ .00			204.6/ .00	

COMPOSITE RESULTS

TEST NUMBER 122
BAROMETER MM HG 735.3
HUMIDITY G/KG 10.3
TEMPERATURE DEG C 24.4

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	363.0	(362.0)
FUEL ECONOMY	MPG	23.19	(23.24)
HYDROCARBONS (THC)	G/MI	.14	(.15)
CARBON MONOXIDE	G/MI	1.93	(2.00)
OXIDES OF NITROGEN	G/MI	.27	(.27)

TABLE C-55

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                     SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                   FTP   - VEHICLE EMISSIONS RESULTS -
                                          PROJECT 08-2809-001

TEST NO.   123          RUN   1                 VEHICLE NO.83                        TEST WEIGHT  1588. KG( 3500. LBS)
VEHICLE MODEL   90 CHEV. LUMINA                 DATE     2/15/90                     ACTUAL ROAD LOAD   4.2 KW(  5.6 HP
ENGINE 2.5 L(153. CID) L-4                      BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-906-F
TRANSMISSION A3                                 DYNO NO.       3                     ODOMETER   6690. KM(  5400. MILES)

BAROMETER 734.06 MM HG(28.90 IN HG)             DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  58. PCT                      ABS. HUMIDITY 10.8 GM/KG             NOX HUMIDITY CORRECTION FACTOR  1.
BAG RESULTS
   BAG NUMBER                                        1              2              3              4
   DESCRIPTION                                COLD TRANSIENT   STABILIZED    HOT TRANSIENT    STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)               734.1 (28.9)   723.9 (28.5)   723.9 (28.5)   723.9 (28.5)
   BLOWER INLET P MM. H2O(IN. H2O)             731.5 (28.8)   723.9 (28.5)   723.9 (28.5)   723.9 (28.5)
   BLOWER INLET TEMP. DEG. C(DEG. F)            42.2 (108.0)   40.6 (105.0)   41.7 (107.0)   41.7 (107.0)
   BLOWER REVOLUTIONS                            40580.         69606.         40525.         69570.
   TOT FLOW STD. CU. METRES(SCF)                75.1 ( 2652.)  129.4 ( 4569.)  75.2 ( 2654.)  129.0 ( 4557.
   THC SAMPLE METER/RANGE/PPM                 53.4/   2/  53.   13.6/   2/  13.   15.8/   2/  16.   11.5/   2/  1
   THC BCKGRD METER/RANGE/PPM                 12.2/   2/  12.   12.5/   2/  12.   10.7/   2/  11.    9.9/   2/  1
   CO  SAMPLE METER/RANGE/PPM                 50.3/  14/ 224.   23.9/  12/  23.   66.1/  12/  66.   25.5/  12/  2
   CO  BCKGRD METER/RANGE/PPM                   .9/  14/   4.    2.1/  12/   2.     .7/  12/   1.     .2/  12/
   CO2 SAMPLE METER/RANGE/PCT                 57.2/   1/1.0494  78.9/  14/ .6393  91.7/  14/ .9091  77.6/  14/ .6
   CO2 BCKGRD METER/RANGE/PCT                  2.7/   1/ .0476  13.3/  14/ .0450  12.8/  14/ .0430  12.8/  14/ .0
   NOX SAMPLE METER/RANGE/PPM                 49.0/   1/ 12.3    9.2/   1/  2.4   29.7/   1/  7.5   10.9/   1/  2
   NOX BCKGRD METER/RANGE/PPM                   .1/   1/   .0     .0/   1/   .0     .0/   1/   .0     .0/   1/
   DILUTION FACTOR                                12.36          20.68          14.50          21.43
   THC CONCENTRATION PPM                           42.             2.             6.             2.
   CO  CONCENTRATION PPM                          212.            21.            62.            24.
   CO2 CONCENTRATION PCT                         1.0056          .5965          .8691          .5759
   NOX CONCENTRATION PPM                          12.3            2.4            7.5            2.8
   THC MASS GRAMS                                 1.88            .13            .26            .16
   CO  MASS GRAMS                                18.49           3.11           5.47           3.59
   CO2 MASS GRAMS                               1382.8         1413.0         1196.0         1360.6
   NOX MASS GRAMS                                 1.77            .59           1.08            .70

   THC  GRAMS/MI                                   .53            .03            .07            .04
   CO   GRAMS/MI                                  5.19            .81           1.54            .93
   CO2  GRAMS/MI                                 387.9          369.4          336.1          354.1
   NOX  GRAMS/MI                                   .50            .16            .30            .18
   FUEL ECONOMY IN MPG                           21.37   22.14  22.92          25.09   24.45  23.89
   RUN TIME               SECONDS                505.           867.           506.           867.
   MEASURED DISTANCE      MI                      3.56    7.39   3.83           3.56    7.40   3.84
   SCF, DRY                                       .971    .974   .975           .972    .974   .975
        DFC, WET (DRY)                                 .940( .922)                    .945( .927)
        TOT VOL (SCM) / SAM BLR (SCM)                 204.5/  .00                    204.2/  .00

COMPOSITE RESULTS                                                                         3-BAG      (4
   TEST NUMBER          123                                  CARBON DIOXIDE       G/MI     364.1      ( 3
   BAROMETER    MM HG  734.1                                 FUEL ECONOMY         MPG      23.12      ( 2
   HUMIDITY     G/KG    10.8                                 HYDROCARBONS (THC)   G/MI       .15      (
   TEMPERATURE  DEG C   23.3                                 CARBON MONOXIDE      G/MI      1.92      (
                                                             OXIDES OF NITROGEN   G/MI       .27      (
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TABLE C-56
SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 131 RUN 1
VEHICLE MODEL 90 CHEV. LUMINA
ENGINE 2.5 L(153. CID) L-4
TRANSMISSION A3

VEHICLE NO.83
DATE 2/21/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 1588. KG(3500. LBS)
ACTUAL ROAD LOAD 4.2 KW(5.6 HP)
GASOLINE EM-907-F
ODOMETER 8822. KM(5482. MILES)

BAROMETER 738.63 MM HG(29.08 IN HG)
RELATIVE HUMIDITY 45. PCT

DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
ABS. HUMIDITY 8.9 GM/KG

NOX HUMIDITY CORRECTION FACTOR .94

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	762.0 (30.0)		762.0 (30.0)	762.0 (30.0)		762.0 (30.0)
BLOWER INLET P MM. H2O(IN. H2O)	762.0 (30.0)		762.0 (30.0)	762.0 (30.0)		762.0 (30.0)
BLOWER INLET TEMP. DEG. C(DEG. F)	43.9 (111.0)		42.2 (108.0)	43.3 (110.0)		42.2 (108.0)
BLOWER REVOLUTIONS	40539.		69474.	40469.		69501.
TOT FLOW STD. CU. METRES(SCF)	75.0 (2648.)		126.9 (4551.)	74.9 (2646.)		128.9 (4553.)
THC SAMPLE METER/RANGE/PPM	62.3/ 2/ 62.		13.1/ 2/ 13.	15.9/ 2/ 16.		10.2/ 2/ 10.
THC BCKGRD METER/RANGE/PPM	12.9/ 2/ 13.		13.1/ 2/ 13.	10.8/ 2/ 11.		9.2/ 2/ 9.
CO SAMPLE METER/RANGE/PPM	56.4/ 14/ 255.		16.6/ 12/ 16.	60.7/ 12/ 60.		11.9/ 12/ 11.
CO BCKGRD METER/RANGE/PPM	.1/ 14/ 0.		.0/ 12/ 0.	.0/ 12/ 0.		.1/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	58.2/ 1/1.0681		79.2/ 14/ .6446	91.9/ 14/ .9142		78.2/ 14/ .6272
CO2 BCKGRD METER/RANGE/PCT	2.7/ 1/ .0476		12.9/ 14/ .0434	12.4/ 14/ .0415		12.0/ 14/ .0399
NOX SAMPLE METER/RANGE/PPM	49.7/ 1/ 12.5		8.3/ 1/ 2.2	32.2/ 1/ 8.1		8.0/ 1/ 2.1
NOX BCKGRD METER/RANGE/PPM	.1/ 1/ .0		.3/ 1/ .1	.3/ 1/ .1		.8/ 1/ .2
DILUTION FACTOR	11.98		20.33	14.28		20.91
THC CONCENTRATION PPM	50.		1.	6.		1.
CO CONCENTRATION PPM	246.		16.	58.		11.
CO2 CONCENTRATION PCT	1.0244		.6033	.8756		.5892
NOX CONCENTRATION PPM	12.4		2.1	8.0		1.9
THC MASS GRAMS	2.25		.05	.26		.11
CO MASS GRAMS	21.45		2.34	5.07		1.66
CO2 MASS GRAMS	1406.5		1423.7	1201.3		1390.8
NOX MASS GRAMS	1.68		.48	1.09		.44
THC GRAMS/MI	.62		.01	.07		.03
CO GRAMS/MI	5.96		.61	1.41		.43
CO2 GRAMS/MI	390.8		367.9	333.9		360.4
NOX GRAMS/MI	.47		.13	.30		.11
FUEL ECONOMY IN MPG	21.08	22.02	22.98	25.20	24.27	23.47
RUN TIME SECONDS	506.		868.	505.		868.
MEASURED DISTANCE MI	3.60	7.47	3.87	3.60	7.46	3.86
SCF, DRY	.975	.978	.979	.976	.978	.979
DFC, WET (DRY)		.938(.925)			.944(.930)	
TOT VOL (SCM) / SAM BLR (SCM)		203.9/ .00			203.9/ .00	

COMPOSITE RESULTS

TEST NUMBER		131
BAROMETER	MM HG	738.6
HUMIDITY	G/KG	8.9
TEMPERATURE	DEG C	24.4

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	363.3	(361.1)
FUEL ECONOMY	MPG	23.11	(23.25)
HYDROCARBONS (THC)	G/MI	.16	(.16)
CARBON MONOXIDE	G/MI	1.94	(1.88)
OXIDES OF NITROGEN	G/MI	.24	(.24)

TABLE C-57

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   132       _    RUN   1           VEHICLE NO.83                     TEST WEIGHT  1588. KG( 3500. LBS)
VEHICLE MODEL   90 CHEV. LUMINA             DATE    2/22/90                   ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
ENGINE 2.5 L(153. CID) L-4                  BAG CART NO. 2 / CVS NO.  2       GASOLINE  EM-907-F
TRANSMISSION A3                             DYNO NO.      3                   ODOMETER   8851. KM(  5500. MILES)

BAROMETER 741.43 MM HG(29.19 IN HG)         DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  26. PCT                  ABS. HUMIDITY  5.1 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .84
BAG RESULTS
  BAG NUMBER                                      1                2                 3                 4
  DESCRIPTION                              COLD TRANSIENT     STABILIZED       HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             762.0 (30.0)     762.0 (30.0)      762.0 (30.0)      762.0 (30.0)
  BLOWER INLET P MM. H2O(IN. H2O)           762.0 (30.0)     762.0 (30.0)      762.0 (30.0)      762.0 (30.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)          43.9 (111.0)     41.7 (107.0)      42.8 (109.0)      42.2 (108.0)
  BLOWER REVOLUTIONS                           40454.           69424.            40514.            69584.
  TOT FLOW STD. CU. METRES(SCF)              75.1 ( 2653.)   129.5 ( 4571.)     75.4 ( 2662.)    129.6 ( 4578.)
  THC SAMPLE METER/RANGE/PPM               51.4/  2/  51.    9.7/  2/  10.     12.4/  2/  12.     7.8/  2/   8.
  THC BCKGRD METER/RANGE/PPM                8.5/  2/   8.    8.5/  2/   8.      6.7/  2/   7.     5.1/  2/   5.
  CO  SAMPLE METER/RANGE/PPM               92.1/ 13/ 227.   22.3/ 12/  22.     68.2/ 12/  68.    39.7/ 12/  39.
  CO  BCKGRD METER/RANGE/PPM                 .2/ 13/   0.     .1/ 12/   0.       .0/ 12/   0.      .0/ 12/   0.
  CO2 SAMPLE METER/RANGE/PCT               56.6/  1/1.0381  78.1/ 14/ .6254    91.2/ 14/ .8965   77.3/ 14/ .6118
  CO2 BCKGRD METER/RANGE/PCT                2.3/  1/ .0406  11.8/ 14/ .0391    11.8/ 14/ .0391   11.2/ 14/ .0369
  NOX SAMPLE METER/RANGE/PPM               56.0/  1/ 14.0    8.6/  1/  2.2     40.2/  1/ 10.1    10.9/  1/  2.8
  NOX BCKGRD METER/RANGE/PPM                 .1/  1/   .0     .1/  1/   .0       .0/  1/   .0      .0/  1/   .0
  DILUTION FACTOR                              12.35            20.94             14.55             21.35
  THC CONCENTRATION PPM                        43.              2.                6.                3.
  CO  CONCENTRATION PPM                        220.             21.               66.               38.
  CO2 CONCENTRATION PCT                        1.0009           .5882             .8601             .5767
  NOX CONCENTRATION PPM                        14.0             2.2               10.1              2.8
  THC MASS GRAMS                               1.94             .12               .28               .23
  CO  MASS GRAMS                               19.23            3.18              5.78              5.76
  CO2 MASS GRAMS                               1377.0           1394.1            1187.3            1368.8
  NOX MASS GRAMS                               1.70             .46               1.23              .59

  THC  GRAMS/MI                                .54              .03               .08               .06
  CO   GRAMS/MI                                5.37             .83               1.61              1.49
  CO2  GRAMS/MI                                384.7            362.6             330.7             353.3
  NOX  GRAMS/MI                                .47              .12               .34               .15
  FUEL ECONOMY IN MPG                          21.47    22.37   23.29             25.42    24.56    23.82
  RUN TIME              SECONDS                505.             868.              506.              868.
  MEASURED DISTANCE     MI                     3.58     7.42    3.85              3.59     7.46     3.87
  SCF, DRY                                     .981     .984    .985              .983     .985     .986
      DFC, WET (DRY)                                .940( .932)                        .945( .937)
      TOT VOL (SCM) / SAM BLR (SCM)                 204.6/  .00                        205.0/  .00

COMPOSITE RESULTS                                                                          3-BAG      (4-BA
  TEST NUMBER          132                                  CARBON DIOXIDE      G/MI      358.4      ( 355.
  BAROMETER    MM HG  741.4                                 FUEL ECONOMY        MPG       23.42      ( 23.5
  HUMIDITY     G/KG     5.1                                 HYDROCARBONS (THC)  G/MI        .15      (   .1
  TEMPERATURE  DEG C   24.4                                 CARBON MONOXIDE     G/MI       1.99      (  2.1
                                                            OXIDES OF NITROGEN  G/MI        .25      (   .2
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TABLE C-58

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                         FTP   - VEHICLE EMISSIONS RESULTS -
                               PROJECT 08-2809-001

TEST NO.   133          RUN   1          VEHICLE NO.83                TEST WEIGHT  1588. KG( 3500. LBS)
VEHICLE MODEL   90 CHEV. LUMINA          DATE    2/23/90              ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
ENGINE 2.5 L(153. CID) L-4               BAG CART NO. 2 / CVS NO.  2  GASOLINE  EM-907-F
TRANSMISSION A3                          DYNO NO.      3              ODOMETER   8882. KM(  5519. MILES)

BAROMETER 748.54 MM HG(29.47 IN HG)      DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
RELATIVE HUMIDITY  22. PCT               ABS. HUMIDITY  4.5 GM/KG     NOX HUMIDITY CORRECTION FACTOR   .83
BAG RESULTS
   BAG NUMBER                                    1               2                3                4
   DESCRIPTION                             COLD TRANSIENT    STABILIZED      HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)            762.0 (30.0)     762.0 (30.0)     762.0 (30.0)     762.0 (30.0)
   BLOWER INLET P MM. H2O(IN. H2O)          762.0 (30.0)     762.0 (30.0)     762.0 (30.0)     762.0 (30.0)
   BLOWER INLET TEMP. DEG. C(DEG. F)         42.2 (108.0)     40.0 (104.0)     42.2 (108.0)     42.2 (108.0)
   BLOWER REVOLUTIONS                          40414.           69307.           40498.           69538.
   TOT FLOW STD. CU. METRES(SCF)             76.1 ( 2687.)   131.0 ( 4627.)    76.3 ( 2692.)   130.9 ( 4623.)
   THC SAMPLE METER/RANGE/PPM             63.6/  2/  63.   11.8/  2/  12.   16.2/  2/  16.   10.4/  2/  10.
   THC BCKGRD METER/RANGE/PPM             12.3/  2/  12.   10.6/  2/  10.    8.5/  2/   8.    8.2/  2/   8.
   CO  SAMPLE METER/RANGE/PPM             86.8/ 13/ 212.   16.7/ 12/  16.   72.0/ 12/  72.   43.3/ 12/  43.
   CO  BCKGRD METER/RANGE/PPM               .0/ 13/   0.     .0/ 12/   0.     .0/ 12/   0.     .5/ 12/   0.
   CO2 SAMPLE METER/RANGE/PCT             94.5/ 14/ .9836  77.3/ 14/ .6118  90.2/ 14/ .8719  77.8/ 14/ .6203
   CO2 BCKGRD METER/RANGE/PCT             12.7/ 14/ .0426  12.4/ 14/ .0415  12.4/ 14/ .0415  12.6/ 14/ .0422
   NOX SAMPLE METER/RANGE/PPM             58.9/  1/ 14.8   11.9/  1/  3.1   39.1/  1/  9.8   13.0/  1/  3.4
   NOX BCKGRD METER/RANGE/PPM               .0/  1/   .0     .0/  1/   .0     .0/  1/   .0     .0/  1/   .0
   DILUTION FACTOR                             13.02            21.41            14.95            21.04
   THC CONCENTRATION PPM                       52.              2.               8.               3.
   CO  CONCENTRATION PPM                      207.             16.              70.              41.
   CO2 CONCENTRATION PCT                      .9443            .5723            .8332            .5801
   NOX CONCENTRATION PPM                      14.8             3.1              9.8              3.4
   THC MASS GRAMS                             2.36              .13              .37              .20
   CO  MASS GRAMS                            18.32             2.42             6.19             6.29
   CO2 MASS GRAMS                           1315.4           1372.9           1163.2           1390.6
   NOX MASS GRAMS                             1.78              .64             1.19              .70

   THC  GRAMS/MI                               .66              .03              .10              .05
   CO   GRAMS/MI                              5.13              .63             1.73             1.63
   CO2  GRAMS/MI                             368.4            357.4            325.8            360.2
   NOX  GRAMS/MI                               .50              .17              .33              .18
   FUEL ECONOMY IN MPG                       22.40    23.03    23.65            25.78    24.46    23.36
   RUN TIME               SECONDS            505.              867.             506.              868.
   MEASURED DISTANCE      MI                 3.57      7.41    3.84             3.57      7.43    3.86
   SCF, DRY                                  .983      .986    .987             .984      .986    .987
        DFC, WET (DRY)                             .942( .936)                        .945( .939)
        TOT VOL (SCM) / SAM BLR (SCM)             207.1/   .00                       207.2/   .00

COMPOSITE RESULTS
   TEST NUMBER         133                                                          3-BAG       (4-BAG)
   BAROMETER    MM HG  748.5                     CARBON DIOXIDE       G/MI          351.0      ( 351.6)
   HUMIDITY     G/KG     4.5                     FUEL ECONOMY         MPG           23.91      ( 23.82)
   TEMPERATURE  DEG C   25.6                     HYDROCARBONS (THC)   G/MI            .18      (   .19)
                                                 CARBON MONOXIDE      G/MI           1.87      (  2.16)
                                                 OXIDES OF NITROGEN   G/MI            .28      (   .29)
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TABLE C-59

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                         SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                       FTP   - VEHICLE EMISSIONS RESULTS -
                                              PROJECT 08-2809-001

TEST NO.   141          RUN  1                  VEHICLE NO.83                       TEST WEIGHT  1588. KG( 3500. LBS)
VEHICLE MODEL   90 CHEV. LUMINA                 DATE    2/28/90                     ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
ENGINE 2.5 L(153. CID) L-4                      BAG CART NO. 2 / CVS NO.  2         GASOLINE  EM-908-F
TRANSMISSION A3                                 DYNO NO.      3                     ODOMETER   9057. KM(  5628. MILES)

BAROMETER 745.24 MM HG(29.34 IN HG)             DRY BULB TEMP. 25.6 DEG C(78.0 DEG F)
RELATIVE HUMIDITY  57. PCT                      ABS. HUMIDITY 11.8 GM/KG            NOX HUMIDITY CORRECTION FACTOR  1.0
BAG RESULTS
  BAG NUMBER                                         1                 2                 3                 4
  DESCRIPTION                                  COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)                 764.5 (30.1)      769.6 (30.3)      769.6 (30.3)      762.0 (30.0)
  BLOWER INLET P MM. H2O(IN. H2O)               762.0 (30.0)      764.5 (30.1)      764.5 (30.1)      762.0 (30.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)              44.4 (112.0)      42.8 (109.0)      44.4 (112.0)      43.3 (110.0)
  BLOWER REVOLUTIONS                              40454.            69429.            40445.            69510.
  TOT FLOW STD. CU. METRES(SCF)                 75.5 ( 2666.)     129.9 ( 4586.)     75.4 ( 2664.)     130.0 ( 4590.)
  THC SAMPLE METER/RANGE/PPM                 62.8/  2/  62.     12.0/  2/  12.    16.7/  2/  17.    11.1/  2/  11.
  THC BCKGRD METER/RANGE/PPM                 10.0/  2/  10.     10.7/  2/  11.    10.3/  2/  10.     9.0/  2/   9.
  CO  SAMPLE METER/RANGE/PPM                 54.5/ 14/ 245.     13.3/ 12/  13.    61.3/ 12/  81.    22.4/ 12/  22.
  CO  BCKGRD METER/RANGE/PPM                   .1/ 14/   0.       .3/ 12/   0.      .3/ 12/   0.      .0/ 12/   0.
  CO2 SAMPLE METER/RANGE/PCT                 96.9/ 14/1.0535    79.1/ 14/ .6428   91.8/ 14/ .9116   78.4/ 14/ .63
  CO2 BCKGRD METER/RANGE/PCT                 13.1/ 14/ .0442    12.8/ 14/ .0430   12.5/ 14/ .0418   12.5/ 14/ .04
  NOX SAMPLE METER/RANGE/PPM                 38.3/  1/  9.6      6.5/  1/  1.7    23.4/  1/  5.9     8.3/  1/  2.2
  NOX BCKGRD METER/RANGE/PPM                   .1/  1/   .0       .1/  1/   .0      .1/  1/   .0      .0/  1/   .
  DILUTION FACTOR                                 12.19             20.46             14.33             20.83
  THC CONCENTRATION PPM                           53.                2.                7.                3.
  CO  CONCENTRATION PPM                           235.               12.               78.               21.
  CO2 CONCENTRATION PCT                           1.0130            .6019             .8727             .5900
  NOX CONCENTRATION PPM                           9.6               1.7               5.9               2.2
  THC MASS GRAMS                                  2.40               .14               .32               .20
  CO  MASS GRAMS                                  20.68             1.84              6.84              3.19
  CO2 MASS GRAMS                                  1400.1            1431.3            1205.4            1405.9
  NOX MASS GRAMS                                  1.44               .43               .89               .56

  THC  GRAMS/MI                                    .67               .04               .09               .05
  CO   GRAMS/MI                                   5.79               .48              1.92               .83
  CO2  GRAMS/MI                                   391.8             374.5             337.6             365.2
  NOX  GRAMS/MI                                    .40               .11               .25               .14
  FUEL ECONOMY IN MPG                             21.00     21.77   22.54             24.83     23.89   23.00
  RUN TIME              SECONDS                   505.              867.              505.              868.
  MEASURED DISTANCE     MI                        3.57      7.40    3.82              3.57      7.42    3.85
  SCF, DRY                                        .971      .974    .975              .973      .975    .976
       DFC, WET (DRY)                                   .939( .922)                        .944( .927)
       TOT VOL (SCM) / SAM BLR (SCM)                    205.4/  .00                        205.4/  .00

COMPOSITE RESULTS
  TEST NUMBER         141                                                               3-BAG       (4-B
  BAROMETER    MM HG  745.2                         CARBON DIOXIDE         G/MI         368.0       ( 365
  HUMIDITY     G/KG    11.8                         FUEL ECONOMY           MPG          22.77       ( 22.
  TEMPERATURE  DEG C   25.6                         HYDROCARBONS (THC)     G/MI           .18       (   .
                                                    CARBON MONOXIDE        G/MI          1.98       (  2.
                                                    OXIDES OF NITROGEN     G/MI           .21       (   .
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TABLE C-60

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
FTP - VEHICLE EMISSIONS RESULTS -
PROJECT 08-2809-001

TEST NO. 142 RUN 1
VEHICLE MODEL 90 CHEV. LUMINA
ENGINE 2.5 L(153. CID) L-4
TRANSMISSION A3

VEHICLE NO. 83
DATE 3/ 1/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 1588. KG(3500. LBS)
ACTUAL ROAD LOAD 4.2 KW(5.6 HP)
GASOLINE EM-908-F
ODOMETER 9091. KM(5649. MILES)

BAROMETER 749.30 MM HG(29.50 IN HG)
RELATIVE HUMIDITY 70. PCT

DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
ABS. HUMIDITY 12.7 GM/KG

NOX HUMIDITY CORRECTION FACTOR 1.07

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	774.7 (30.5)		782.3 (30.8)	774.7 (30.5)		774.7 (30.5)
BLOWER INLET P MM. H2O(IN. H2O)	769.6 (30.3)		779.8 (30.7)	769.6 (30.3)		769.6 (30.3)
BLOWER INLET TEMP. DEG. C(DEG. F)	42.8 (109.0)		39.4 (103.0)	42.2 (108.0)		41.7 (107.0)
BLOWER REVOLUTIONS	40461.		69502.	40437.		69537.
TOT FLOW STD. CU. METRES(SCF)	76.1 (2687.)		131.4 (4638.)	76.1 (2688.)		131.0 (4627.)
THC SAMPLE METER/RANGE/PPM	62.5/ 2/ 62.		9.0/ 2/ 9.	13.2/ 2/ 13.		8.9/ 2/ 9.
THC BCKGRD METER/RANGE/PPM	7.1/ 2/ 7.		7.8/ 2/ 8.	7.3/ 2/ 7.		7.4/ 2/ 7.
CO SAMPLE METER/RANGE/PPM	59.1/ 14/ 270.		17.1/ 12/ 17.	74.2/ 12/ 74.		23.6/ 12/ 23.
CO BCKGRD METER/RANGE/PPM	.1/ 14/ 0.		.1/ 12/ 0.	.2/ 12/ 0.		.4/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	96.4/ 14/1.0385		78.7/ 14/ .6358	91.5/ 14/ .9040		77.8/ 14/ .6203
CO2 BCKGRD METER/RANGE/PCT	12.6/ 14/ .0422		12.5/ 14/ .0418	12.6/ 14/ .0422		12.8/ 14/ .0430
NOX SAMPLE METER/RANGE/PPM	48.0/ 1/ 12.0		8.8/ 1/ 2.3	32.1/ 1/ 8.1		7.9/ 1/ 2.1
NOX BCKGRD METER/RANGE/PPM	.0/ 1/ .0		.0/ 1/ .0	.1/ 1/ .0		.0/ 1/ .0
DILUTION FACTOR	12.33		20.68	14.47		21.18
THC CONCENTRATION PPM	55.		2.	6.		2.
CO CONCENTRATION PPM	258.		16.	71.		22.
CO2 CONCENTRATION PCT	.9997		.5960	.8647		.5793
NOX CONCENTRATION PPM	12.0		2.3	8.1		2.1
THC MASS GRAMS	2.53		.12	.29		.14
CO MASS GRAMS	22.82		2.43	6.26		3.32
CO2 MASS GRAMS	1392.7		1433.3	1205.2		1389.9
NOX MASS GRAMS	1.88		.62	1.26		.55
THC GRAMS/MI	.70		.03	.08		.04
CO GRAMS/MI	6.36		.63	1.75		.87
CO2 GRAMS/MI	388.3		373.0	336.0		362.3
NOX GRAMS/MI	.52		.16	.35		.14
FUEL ECONOMY IN MPG	21.13	21.88	22.63	24.97	24.06	23.26
RUN TIME SECONDS	505.		868.	505.		868.
MEASURED DISTANCE MI	3.59	7.43	3.84	3.59	7.42	3.84
SCF, DRY	.967	.970	.971	.969	.970	.971
DFC, WET (DRY)		.940(.919)			.945(.923)	
TOT VOL (SCM) / SAM BLR (SCM)		207.4/ .00			207.2/ .00	

COMPOSITE RESULTS

TEST NUMBER		142
BAROMETER	MM HG	749.3
HUMIDITY	G/KG	12.7
TEMPERATURE	DEG C	23.3

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	366.0	(362.8)
FUEL ECONOMY	MPG	22.88	(23.07)
HYDROCARBONS (THC)	G/MI	.18	(.19)
CARBON MONOXIDE	G/MI	2.13	(2.20)
OXIDES OF NITROGEN	G/MI	.29	(.28)

TABLE C-61

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                          FTP   - VEHICLE EMISSIONS RESULTS -
                                 PROJECT 08-2809-001

TEST NO.   143          RUN   1               VEHICLE NO.83                          TEST WEIGHT  1588. KG( 3500. LBS)
VEHICLE MODEL   90 CHEV. LUMINA               DATE    3/ 2/90                        ACTUAL ROAD LOAD   4.2 KW(  5.6 HP)
ENGINE 2.5 L(153. CID) L-4                    BAG CART NO. 2 / CVS NO.  2            GASOLINE  EM-908-F
TRANSMISSION A3                               DYNO NO.      3                        ODOMETER   9123. KM(  5669. MILES)

BAROMETER 745.74 MM HG(29.36 IN HG)           DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  30. PCT                    ABS. HUMIDITY  5.5 GM/KG               NOX HUMIDITY CORRECTION FACTOR   .
BAG RESULTS
   BAG NUMBER                                      1                 2                 3                 4
   DESCRIPTION                              COLD TRANSIENT      STABILIZED       HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)            767.1 (30.2)      774.7 (30.5)      774.7 (30.5)      736.6 (29.0)
   BLOWER INLET P MM. H2O(IN. H2O)          764.5 (30.1)      769.6 (30.3)      769.6 (30.3)      736.6 (29.0)
   BLOWER INLET TEMP. DEG. C(DEG. F)         44.4 (112.0)      41.7 (107.0)      43.9 (111.0)      42.2 (108.0)
   BLOWER REVOLUTIONS                          40490.            69459.            40447.            69495.
   TOT FLOW STD. CU. METRES(SCF)             75.6 ( 2669.)    130.2 ( 4598.)     75.5 ( 2667.)    130.8 ( 4618.
   THC SAMPLE METER/RANGE/PPM             70.8/   2/  70.     9.0/   2/   9.    12.3/   2/  12.    10.6/   2/  10
   THC BCKGRD METER/RANGE/PPM              7.5/   2/   7.     8.1/   2/   8.     7.4/   2/   7.     9.5/   2/   9
   CO  SAMPLE METER/RANGE/PPM             71.3/  14/ 337.    19.6/  12/  19.    82.4/  12/  82.    31.0/  12/  30
   CO  BCKGRD METER/RANGE/PPM               .3/  14/   1.      .5/  12/   0.      .2/  12/   0.     3.2/  12/   3
   CO2 SAMPLE METER/RANGE/PCT             58.4/   1/1.0718   79.6/  14/ .6517   92.1/  14/ .9193   78.7/  14/ .63
   CO2 BCKGRD METER/RANGE/PCT              2.3/   1/ .0406   12.5/  14/ .0418   12.3/  14/ .0411   13.3/  14/ .04
   NOX SAMPLE METER/RANGE/PPM             51.0/   1/ 12.8     8.5/   1/  2.2    31.8/   1/  8.0     8.8/   1/  2.
   NOX BCKGRD METER/RANGE/PPM               .1/   1/   .0      .1/   1/   .0      .4/   1/   .1      .2/   1/   .
   DILUTION FACTOR                             11.88             20.17             14.22             20.64
   THC CONCENTRATION PPM                       63.               1.                5.                2.
   CO  CONCENTRATION PPM                       325.              18.               80.               27.
   CO2 CONCENTRATION PCT                       1.0347            .6119             .8811             .5930
   NOX CONCENTRATION PPM                       12.8              2.2               7.9               2.2
   THC MASS GRAMS                              2.87              .10               .24               .12
   CO  MASS GRAMS                              28.63             2.75              7.02              4.07
   CO2 MASS GRAMS                              1432.0            1458.8            1218.3            1420.0
   NOX MASS GRAMS                              1.57              .46               .98               .48

   THC  GRAMS/MI                               .79               .03               .07               .03
   CO   GRAMS/MI                               7.94              .70               1.94              1.05
   CO2  GRAMS/MI                               397.0             374.3             337.1             366.0
   NOX  GRAMS/MI                               .44               .12               .27               .12
   FUEL ECONOMY IN MPG                      20.55     21.54     22.54             24.87     23.87     23.01
   RUN TIME               SECONDS           505.                867.              505.                868.
   MEASURED DISTANCE      MI                3.61      7.50      3.90              3.61      7.49      3.88
   SCF, DRY                                 .980      .982      .984              .981      .983      .984
        DFC, WET (DRY)                               .938( .929)                          .944( .934)
        TOT VOL (SCM) / SAM BLR (SCM)               205.8/   .00                          206.3/   .00

COMPOSITE RESULTS
   TEST NUMBER          143                                                                  3-BAG      (4-
   BAROMETER    MM HG  745.7                          CARBON DIOXIDE        G/MI             368.8      ( 36
   HUMIDITY     G/KG     5.5                          FUEL ECONOMY          MPG              22.67      ( 22.
   TEMPERATURE  DEG C   23.3                          HYDROCARBONS (THC)    G/MI               .20      (   .
                                                      CARBON MONOXIDE       G/MI              2.54      (  2.
                                                      OXIDES OF NITROGEN    G/MI               .23      (   .
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COMPUTER PRINTOUTS OF REGULATED EMISSIONS AND FUEL ECONOMY FROM TEST VEHICLE 5, A 1990 FORD PROBE

Test Fuel	Test No.	Table C-
Baseline (EM-905-F)	511	62
	512	63
	513	64
	514	65
	515	66
	516	67
10% Ethanol (EM-906-F)	521	68
	522	69
	523	70
16.4% MTBE (EM-907-F)	531	71
	532	72
	533	73
19.1% ETBE (EM-908-F)	541	74
	542	75
	543	76

TABLE C-62

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                 FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   511          RUN                VEHICLE NO.                        TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE              DATE    5/24/90                    ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
ENGINE 3.0 L(183. CID)  -6                 BAG CART NO. 2 / CVS NO.  2        GASOLINE  EM-905-F
TRANSMISSION A3                            DYNO NO.      3                    ODOMETER  18627. KM( 11574. MILES)

BAROMETER 737.36 MM HG(29.03 IN HG)        DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  49. PCT                 ABS. HUMIDITY  9.6 GM/KG           NOX HUMIDITY CORRECTION FACTOR   .96
BAG RESULTS
   BAG NUMBER                                   1                 2                3                  4
   DESCRIPTION                            COLD TRANSIENT     STABILIZED      HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)           787.4 (31.0)     787.4 (31.0)     784.9 (30.9)      784.9 (30.9)
   BLOWER INLET P MM. H2O(IN. H2O)         787.4 (31.0)     787.4 (31.0)     782.3 (30.8)      782.3 (30.8)
   BLOWER INLET TEMP. DEG. C(DEG. F)        42.8 (109.0)     41.7 (107.0)     41.7 (107.0)      42.2 (108.0)
   BLOWER REVOLUTIONS                        40490.           69502.           40373.            69372.
   TOT FLOW STD. CU. METRES(SCF)            74.6 ( 2635.)   128.3 ( 4532.)    74.6 ( 2634.)    128.1 ( 4522.)
   THC SAMPLE METER/RANGE/PPM             73.4/  2/  73.    11.5/  2/  11.    24.1/  2/  24.    12.9/  2/  13.
   THC BCKGRD METER/RANGE/PPM             10.2/  2/  10.    10.5/  2/  10.    10.1/  2/  10.    11.2/  2/  11.
   CO  SAMPLE METER/RANGE/PPM             74.4/ 14/ 354.    27.2/ 12/  27.    53.3/ 13/ 125.    63.5/ 12/  63.
   CO  BCKGRD METER/RANGE/PPM               .3/ 14/   1.      .9/ 12/   1.      .3/ 13/   1.     1.6/ 12/   2.
   CO2 SAMPLE METER/RANGE/PCT             71.3/  1/1.3140   88.2/ 14/ .8250   62.3/  1/1.1448   87.8/ 14/ .8159
   CO2 BCKGRD METER/RANGE/PCT              2.9/  1/ .0512   13.8/ 14/ .0470    2.8/  1/ .0494   12.7/ 14/ .0426
   NOX SAMPLE METER/RANGE/PPM             38.5/  2/ 38.5    58.3/  1/ 14.6    32.1/  2/ 32.1    46.9/  1/ 11.8
   NOX BCKGRD METER/RANGE/PPM               .3/  2/   .3      .4/  1/   .1      .2/  2/   .2      .5/  1/   .1
   DILUTION FACTOR                             10.03             16.41            11.73             16.51
   THC CONCENTRATION PPM                       64.                2.              15.                2.
   CO  CONCENTRATION PPM                       339.               25.             120.               60.
   CO2 CONCENTRATION PCT                       1.2679            .7009           1.0996             .7759
   NOX CONCENTRATION PPM                       38.3              14.5            32.0               11.6
   THC MASS GRAMS                              2.72               .12              .63               .17
   CO  MASS GRAMS                              29.46             3.72            10.41              8.07
   CO2 MASS GRAMS                              1732.3           1834.9           1501.9            1819.0
   NOX MASS GRAMS                              5.26              3.43             4.40              2.75

   THC  GRAMS/MI                                .76               .03              .18               .04
   CO   GRAMS/MI                               8.20               .96             2.90              2.29
   CO2  GRAMS/MI                               482.1             472.0            417.8             469.7
   NOX  GRAMS/MI                               1.46               .88             1.22               .71
   FUEL ECONOMY IN MPG                         18.21    18.68    19.13            21.42    20.17    19.13
   RUN TIME            SECONDS                 505.              868.             505.              867.
   MEASURED DISTANCE    MI                     3.59     7.48     3.89             3.59     7.47     3.87
   SCF, DRY                                    .973     .975     .977             .974     .976     .977
        DFC, WET (DRY)                              .925( .910)                        .930( .916)
        TOT VOL (SCM) / SAM BLR (SCM)              203.0/  .00                         202.7/  .00

COMPOSITE RESULTS                                                                            3-BAG     (4-BAG
   TEST NUMBER         511                                   CARBON DIOXIDE       G/MI       459.3     ( 458.6
   BAROMETER     MM HG  737.4                                FUEL ECONOMY         MPG        19.49     ( 19.50
   HUMIDITY      G/KG     9.6                                HYDROCARBONS (THC)   G/MI         .22     (   .22
   TEMPERATURE   DEG C   24.4                                CARBON MONOXIDE      G/MI        2.98     (  3.38
                                                             OXIDES OF NITROGEN   G/MI        1.10     (  1.05
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TABLE C-63

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                    PROJECT 08-2809-001

TEST NO.   512          RUN
VEHICLE MODEL   90 FORD PROBE               VEHICLE NO.
ENGINE 3.0 L(183. CID)  -6                  DATE     5/25/90                  TEST WEIGHT  1701. KG( 3750. LBS)
TRANSMISSION A3                             BAG CART NO. 2 / CVS NO.  2       ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
                                            DYNO NO.      3                   GASOLINE  EM-905-F
                                                                              ODOMETER  18656. KM( 11592. MILES)
BAROMETER 737.67 MM HG(29.05 IN HG)
RELATIVE HUMIDITY  61. PCT                  DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
BAG RESULTS                                 ABS. HUMIDITY 10.5 GM/KG          NOX HUMIDITY CORRECTION FACTOR   .99
   BAG NUMBER
   DESCRIPTION                                    1                  2                  3                  4
                                            COLD TRANSIENT       STABILIZED       HOT TRANSIENT       STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)
   BLOWER INLET P MM. H2O(IN. H2O)           774.7 (30.5)       774.7 (30.5)       774.7 (30.5)       774.7 (30.5)
   BLOWER INLET TEMP. DEG. C(DEG. F)         762.0 (30.0)       774.7 (30.5)       774.7 (30.5)       774.7 (30.5)
   BLOWER REVOLUTIONS                         43.3 (110.0)       40.6 (105.0)       42.2 (108.0)       41.1 (106.0)
   TOT FLOW STD. CU. METRES(SCF)               40484.             69481.             40422.             69378.
   THC SAMPLE METER/RANGE/PPM                 74.8 ( 2643.)      128.9 ( 4552.)      74.8 ( 2640.)      128.6 ( 4540.)
   THC BCKGRD METER/RANGE/PPM              75.8/   2/  75.    10.9/   2/  11.    23.5/   2/  23.     10.8/   2/  11.
   CO  SAMPLE METER/RANGE/PPM               9.0/   2/   9.    10.0/   2/  10.     9.4/   2/   9.      9.4/   2/   9.
   CO  BCKGRD METER/RANGE/PPM              81.7/  14/ 397.    38.8/  12/  38.    54.4/  13/ 128.     36.9/  12/  36.
   CO2 SAMPLE METER/RANGE/PCT                .1/  14/   0.      .9/  12/   1.      .1/  13/   0.       .1/  12/   0.
   CO2 BCKGRD METER/RANGE/PCT              70.9/   1/1.3064   88.9/  14/ .8411   63.6/   1/1.1692    87.8/  14/ .8159
   NOX SAMPLE METER/RANGE/PPM               2.4/   1/ .0423   12.8/  14/ .0430    2.7/   1/ .0476    13.2/  14/ .0446
   NOX BCKGRD METER/RANGE/PPM              37.3/   2/ 37.3    50.8/   1/ 12.7    32.1/   2/ 32.1     55.3/   1/ 13.9
   DILUTION FACTOR                           .0/   2/  .0      .3/   1/   .1      .2/   2/  .2       .5/   1/   .1
   THC CONCENTRATION PPM                       10.06              16.07              11.49              16.57
   CO  CONCENTRATION PPM                       67.                2.                 15.                2.
   CO2 CONCENTRATION PCT                       379.               36.                122.               35.
   NOX CONCENTRATION PPM                       1.2683             .8007              1.1257             .7740
   THC MASS GRAMS                              37.3               12.7               32.0               13.7
   CO  MASS GRAMS                              2.88               .11                .63                .14
   CO2 MASS GRAMS                              33.00              5.39               10.65              5.21
   NOX MASS GRAMS                              1737.9             1889.9             1540.8             1822.2
                                               5.31               3.10               4.54               3.36
   THC  GRAMS/MI
   CO   GRAMS/MI                               .80                .03                .18                .04
   CO2  GRAMS/MI                               9.23               1.40               2.98               1.35
   NOX  GRAMS/MI                               486.3              490.6              430.8              472.4
   FUEL ECONOMY IN MPG                         1.49               .81                1.27               .87
   RUN TIME              SECONDS               18.00      18.19   18.38              20.77      19.86   19.08
   MEASURED DISTANCE     MI                    505.               867.               505.               867.
   SCF, DRY                                    3.57       7.43    3.85               3.58       7.43    3.86
        DFC, WET (DRY)                         .969       .971    .973               .970       .972    .973
        TOT VOL (SCM) / SAM BLR (SCM)                .924( .906)                           .930( .912)
                                                   203.8/    .00                           203.3/   .00
POSITE RESULTS
  TEST NUMBER         512
  BAROMETER     MM HG  737.9                                                        3-BAG       (4-BAG)
  HUMIDITY      G/KG    10.5                    CARBON DIOXIDE        G/MI          473.3      ( 467.9)
  TEMPERATURE   DEG C   22.2                    FUEL ECONOMY          MPG           18.89      ( 19.11)
                                                HYDROCARBONS (THC)    G/MI            .23      (   .23)
                                                CARBON MONOXIDE       G/MI           3.45      (  3.44)
                                                OXIDES OF NITROGEN    G/MI           1.07      (  1.09)
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TABLE C-64

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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                          FTP   - VEHICLE EMISSIONS RESULTS -
                               PROJECT 08-2809-001

TEST NO.   513          RUN            VEHICLE NO.                          TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE          DATE    5/31/90                      ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
ENGINE 3.0 L(183. CID)  -6             BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-905-F
TRANSMISSION A3                        DYNO NO.       3                     ODOMETER  18862. KM( 11720. MILES)

BAROMETER 737.36 MM HG(29.03 IN HG)    DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  70. PCT             ABS. HUMIDITY 13.0 GM/KG             NOX HUMIDITY CORRECTION FACTOR  1.08
BAG RESULTS
   BAG NUMBER                                 1                   2                    3                    4
   DESCRIPTION                         COLD TRANSIENT         STABILIZED          HOT TRANSIENT          STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)         769.6 (30.3)        767.1 (30.2)        769.6 (30.3)         769.6 (30.3)
   BLOWER INLET P MM. H2O(IN. H2O)       767.1 (30.2)        764.5 (30.1)        767.1 (30.2)         767.1 (30.2)
   BLOWER INLET TEMP. DEG. C(DEG. F)      43.3 (110.0)        40.6 (105.0)        42.2 (108.0)         40.0 (104.0)
   BLOWER REVOLUTIONS                       40507.              69451.              40500.               69361.
   TOT FLOW STD. CU. METRES(SCF)          74.8 ( 2641.)      128.9 ( 4553.)       74.9 ( 2646.)       128.9 ( 4550.)
   THC SAMPLE METER/RANGE/PPM          84.2/   2/  83.     15.1/   2/  15.     26.8/   2/  27.      13.1/   2/  13.
   THC BCKGRD METER/RANGE/PPM          13.2/   2/  13.     13.3/   2/  13.     11.9/   2/  12.      11.6/   2/  11.
   CO  SAMPLE METER/RANGE/PPM          86.2/  14/ 423.     64.2/  12/  64.     80.2/  13/ 195.      50.7/  12/  50.
   CO  BCKGRD METER/RANGE/PPM            .0/  14/   0.       .0/  12/   0.       .6/  13/   1.        .4/  12/   0.
   CO2 SAMPLE METER/RANGE/PCT          69.5/   1/1.2800    88.5/  14/ .8318    60.7/   1/1.1148     87.0/  14/ .7982
   CO2 BCKGRD METER/RANGE/PCT           2.5/   1/ .0441    13.3/  14/ .0450     2.8/   1/ .0494     13.4/  14/ .0454
   NOX SAMPLE METER/RANGE/PPM          35.7/   2/ 35.7     51.4/   1/ 12.9     31.2/   2/ 31.2      49.2/   1/ 12.3
   NOX BCKGRD METER/RANGE/PPM            .0/   2/   .0       .1/   1/   .0       .1/   2/   .1        .0/   1/   .0
   DILUTION FACTOR                           10.23               16.20               11.97                16.90
   THC CONCENTRATION PPM                     72.                  3.                 16.                   2.
   CO  CONCENTRATION PPM                    403.                 61.                185.                  48.
   CO2 CONCENTRATION PCT                    1.2402               .7896              1.0696                .7555
   NOX CONCENTRATION PPM                    35.7                12.9                31.2                 12.3
   THC MASS GRAMS                            3.07                 .19                 .68                  .16
   CO  MASS GRAMS                           35.12                9.18               16.14                 7.16
   CO2 MASS GRAMS                          1698.5              1864.1              1467.3               1782.2
   NOX MASS GRAMS                            5.52                3.42                4.82                 3.28

   THC  GRAMS/MI                              .87                 .05                 .19                  .04
   CO   GRAMS/MI                             9.95                2.46                4.54                 1.87
   CO2  GRAMS/MI                            481.2               499.1               413.1                466.5
   NOX  GRAMS/MI                             1.56                 .92                1.36                  .86
   FUEL ECONOMY IN MPG                      18.13      18.07    18.01               21.53      20.31     19.29
   RUN TIME              SECONDS            505.                867.                506.                 867.
   MEASURED DISTANCE     MI                  3.53       7.27     3.74                3.55       7.37      3.82
   SCF, DRY                                  .966       .969     .970                .968       .969      .970
        DFC, WET (DRY)                           .925( .904)                              .932( .911)
        TOT VOL (SCM) / SAM BLR (SCM)            203.7/   .00                             203.8/   .00

COMPOSITE RESULTS
   TEST NUMBER          513                                                            3-BAG       (4-BAG)
   BAROMETER    MM HG  737.4                       CARBON DIOXIDE        G/MI          471.4      ( 462.1)
   HUMIDITY     G/KG    13.0                       FUEL ECONOMY          MPG           18.89      ( 19.28)
   TEMPERATURE  DEG C   23.3                       HYDROCARBONS (THC)    G/MI            .26      (   .26)
                                                   CARBON MONOXIDE       G/MI           4.60      (  4.42)
                                                   OXIDES OF NITROGEN    G/MI           1.17      (  1.16)
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TABLE C-65

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                SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                           FTP   - VEHICLE EMISSIONS RESULTS -
                                PROJECT 08-2809-001

TEST NO.   514           RUN                VEHICLE NO.                      TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE               DATE     6/ 8/90                 ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
ENGINE 3.0 L(183. CID)  -6                  BAG CART NO. 2 / CVS NO.  2      GASOLINE  EM-905-F
TRANSMISSION A3                             DYNO NO.      3                  ODOMETER  19090. KM( 11862. MILES)

BAROMETER 740.16 MM HG(29.14 IN HG)         DRY BULB TEMP. 21.7 DEG C(71.0 DEG F)
RELATIVE HUMIDITY  64. PCT                  ABS. HUMIDITY 10.7 GM/KG         NOX HUMIDITY CORRECTION FACTOR  1.00
BAG RESULTS
  BAG NUMBER                                    1                  2                   3                  4
  DESCRIPTION                             COLD TRANSIENT       STABILIZED         HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             769.6 (30.3)       769.6 (30.3)       769.6 (30.3)       769.6 (30.3)
  BLOWER INLET P MM. H2O(IN. H2O)           767.1 (30.2)       767.1 (30.2)       767.1 (30.2)       767.1 (30.2)
  BLOWER INLET TEMP. DEG. C(DEG. F)          43.3 (110.0)       41.7 (107.0)       43.3 (110.0)       41.7 (107.0)
  BLOWER REVOLUTIONS                         40498.             69431.             40411.             69357.
  TOT FLOW STD. CU. METRES(SCF)             75.1 ( 2652.)      129.1 ( 4560.)      74.9 ( 2646.)     129.0 ( 4554.)
  THC SAMPLE METER/RANGE/PPM             92.4/   2/  91.     14.1/   2/  14.     28.9/   2/  29.     11.5/   2/  11.
  THC BCKGRD METER/RANGE/PPM             12.2/   2/  12.     11.8/   2/  12.     11.6/   2/  11.      8.9/   2/   9.
  CO  SAMPLE METER/RANGE/PPM             88.6/  14/ 437.     71.2/  12/  71.     50.5/  14/ 225.     82.1/  12/  82.
  CO  BCKGRD METER/RANGE/PPM               .2/  14/   1.       .0/  12/   0.       .0/  14/   0.       .1/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT             69.5/   1/1.2800    88.7/  14/ .8364    60.6/   1/1.1130    87.6/  14/ .8114
  CO2 BCKGRD METER/RANGE/PCT              2.6/   1/ .0459    12.9/  14/ .0434     2.6/   1/ .0459    12.4/  14/ .0415
  NOX SAMPLE METER/RANGE/PPM             35.4/   2/ 35.4     51.9/   1/ 13.0     29.8/   2/ 29.8     47.2/   1/ 11.8
  NOX BCKGRD METER/RANGE/PPM               .5/   2/   .5      1.2/   1/   .3       .3/   2/   .3      1.1/   1/   .3
  DILUTION FACTOR                            10.22              16.10              11.95              16.57
  THC CONCENTRATION PPM                      81.                 3.                18.                 3.
  CO  CONCENTRATION PPM                     417.                68.               215.                79.
  CO2 CONCENTRATION PCT                     1.2387              .7957             1.0709              .7725
  NOX CONCENTRATION PPM                     35.0               12.7               29.6               11.6
  THC MASS GRAMS                             3.47               .22                .78                .23
  CO  MASS GRAMS                            36.43             10.24              18.77              11.85
  CO2 MASS GRAMS                           1703.1            1881.2             1469.1             1824.2
  NOX MASS GRAMS                             5.03              3.14               4.24               2.85

  THC  GRAMS/MI                              .95                .06                .22                .06
  CO   GRAMS/MI                            10.01               2.63               5.21               3.04
  CO2  GRAMS/MI                            468.0              482.2              408.0              468.6
  NOX  GRAMS/MI                             1.38                .81               1.18                .73
  FUEL ECONOMY IN MPG                      18.61     18.61    18.62              21.73     20.30    19.13
  RUN TIME               SECONDS           505.               867.               505.               867.
  MEASURED DISTANCE      MI                 3.64      7.54     3.90               3.60      7.49     3.89
  SCF, DRY                                  .968      .970     .972               .969      .971     .972
      DFC. WET (DRY)                             .925( .905)                          .931( .912)
      TOT VOL (SCM) / SAM BLR (SCM)              204.2/   .00                         203.9/   .00

MPOSITE RESULTS
  TEST NUMBER         514                                                          3-BAG       (4-BAG)
  BAROMETER    MM HG  740.2                    CARBON DIOXIDE         G/MI         459.0       ( 454.9)
  HUMIDITY     G/KG    10.7                    FUEL ECONOMY           MPG          19.38       ( 19.54)
  TEMPERATURE  DEG C   21.7                    HYDROCARBONS (THC)     G/MI           .29       (   .29)
                                               CARBON MONOXIDE        G/MI          4.87       (  4.99)
                                               OXIDES OF NITROGEN     G/MI          1.03       (  1.01)
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TABLE C-66

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                     SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                  FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   515          RUN                  VEHICLE NO.                         TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE                DATE    6/14/90                     ACTUAL ROAD LOAD   6.0 KW(  8.1 HP
ENGINE 3.0 L(183. CID)  -6                   BAG CART NO. 2 / CVS NO.  2         GASOLINE  EM-905-F
TRANSMISSION A3                              DYNO NO.      3                     ODOMETER  19263. KM( 11962. MILES

BAROMETER 740.66 MM HG(29.16 IN HG)          DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  70. PCT                   ABS. HUMIDITY 12.9 GM/KG            NOX HUMIDITY CORRECTION FACTOR  1.
BAG RESULTS
  BAG NUMBER                                      1                 2                 3                 4
  DESCRIPTION                              COLD TRANSIENT      STABILIZED      HOT TRANSIENT       STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             787.4 (31.0)     787.4 (31.0)     787.4 (31.0)     787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)           787.4 (31.0)     787.4 (31.0)     787.4 (31.0)     787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)          42.8 (109.0)     42.8 (109.0)     42.8 (109.0)     42.8 (109.0)
  BLOWER REVOLUTIONS                           40463.           69371.           40388.           69343.
  TOT FLOW STD. CU. METRES(SCF)              74.9 ( 2646.)   128.5 ( 4537.)    74.8 ( 2641.)   128.4 ( 4535
  THC SAMPLE METER/RANGE/PPM               9.2/   3/  92.   12.8/   2/  13.   27.5/   2/  27.   11.6/   2/  1
  THC BCKGRD METER/RANGE/PPM                .9/   3/   9.    9.8/   2/  10.   10.1/   2/  10.    9.9/   2/  1
  CO  SAMPLE METER/RANGE/PPM              53.2/   1/ 458.   68.1/  12/  68.   83.9/  13/ 205.   61.0/  12/  6
  CO  BCKGRD METER/RANGE/PPM                .0/   1/   0.     .5/  12/   0.     .0/  13/   0.     .4/  12/
  CO2 SAMPLE METER/RANGE/PCT              70.6/   1/1.3000  88.4/  14/ .8295  59.9/   1/1.0999  86.8/  14/ .7
  CO2 BCKGRD METER/RANGE/PCT               2.2/   1/ .0388  12.6/  14/ .0422   2.6/   1/ .0459  12.9/  14/ .0
  NOX SAMPLE METER/RANGE/PPM              49.0/   2/ 49.0   56.5/   1/ 14.2   27.7/   2/ 27.8   47.0/   1/ 11
  NOX BCKGRD METER/RANGE/PPM                .2/   2/   .2     .8/   1/   .2     .1/   2/   .1     .4/   1/
  DILUTION FACTOR                              10.04            16.24            12.12            16.98
  THC CONCENTRATION PPM                        84.               4.              18.               2.
  CO  CONCENTRATION PPM                        437.              65.              196.             58.
  CO2 CONCENTRATION PCT                        1.2658           .7899            1.0578           .7529
  NOX CONCENTRATION PPM                        48.8             14.0             27.7             11.7
  THC MASS GRAMS                                3.60             .26              .77              .17
  CO  MASS GRAMS                               38.11            9.65            17.05             8.63
  CO2 MASS GRAMS                              1736.8           1858.0           1448.6           1770.3
  NOX MASS GRAMS                                7.54            3.69             4.26             3.09

  THC  GRAMS/MI                                 1.01             .07              .22              .04
  CO   GRAMS/MI                                10.70            2.53             4.80             2.28
  CO2  GRAMS/MI                                487.8           486.1            407.7            468.6
  NOX  GRAMS/MI                                 2.12             .97             1.20              .82
  FUEL ECONOMY IN MPG                          17.84     18.16   18.48           21.78     20.35   19.18
  RUN TIME           SECONDS                   505.              868.            505.              867.
  MEASURED DISTANCE    MI                       3.56      7.38   3.82             3.55      7.33   3.78
  SCF, DRY                                      .966      .969   .970             .968      .969   .970
      DFC, WET (DRY)                                  .924( .904)                       .932( .911)
      TOT VOL (SCM) / SAM BLR (SCM)                 203.4/   .00                      203.2/   .00

COMPOSITE RESULTS                                                                            3-BAG        (4-
  TEST NUMBER         515                                  CARBON DIOXIDE      G/MI         464.5        ( 45
  BAROMETER    MM HG  740.7                                FUEL ECONOMY        MPG          19.13        ( 19
  HUMIDITY     G/KG    12.9                                HYDROCARBONS (THC)  G/MI           .30        (
  TEMPERATURE  DEG C   23.3                                CARBON MONOXIDE     G/MI          4.85        ( 4
  OXIDES OF NITROGEN  G/MI                                                                   1.27        (
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TABLE C-67

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

FTP - VEHICLE EMISSIONS RESULTS -

PROJECT 08-2809-001

TEST NO. 516 RUN
VEHICLE MODEL 90 FORD PROBE
ENGINE 3.0 L(183. CID) -6
TRANSMISSION A3

VEHICLE NO.
DATE 6/15/90
BAG CART NO. 2 / CVS NO. 2
DYNO NO. 3

TEST WEIGHT 1701. KG(3750. LBS)
ACTUAL ROAD LOAD 6.0 KW(8.1 HP)
GASOLINE EM-905-F
ODOMETER 19314. KM(12001. MILES)

BAROMETER 739.14 MM HG(29.10 IN HG)
RELATIVE HUMIDITY 61. PCT

DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
ABS. HUMIDITY 10.5 GM/KG

NOX HUMIDITY CORRECTION FACTOR .99

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	787.4 (31.0)		787.4 (31.0)	787.4 (31.0)		784.9 (30.9)
BLOWER INLET P MM. H2O(IN. H2O)	787.4 (31.0)		787.4 (31.0)	787.4 (31.0)		782.3 (30.8)
BLOWER INLET TEMP. DEG. C(DEG. F)	43.3 (110.0)		42.8 (109.0)	42.8 (109.0)		42.8 (109.0)
BLOWER REVOLUTIONS	40443.		69358.	40383.		69286.
TOT FLOW STD. CU. METRES(SCF)	74.7 (2636.)		128.2 (4525.)	74.6 (2635.)		128.1 (4523.)
THC SAMPLE METER/RANGE/PPM	11.4/ 3/ 114.		13.1/ 2/ 13.	27.5/ 2/ 27.		13.4/ 2/ 13.
THC BCKGRD METER/RANGE/PPM	1.3/ 3/ 13.		11.7/ 2/ 12.	11.8/ 2/ 12.		12.3/ 2/ 12.
CO SAMPLE METER/RANGE/PPM	57.4/ 1/ 504.		15.0/ 14/ 61.	78.8/ 13/ 191.		60.4/ 12/ 60.
CO BCKGRD METER/RANGE/PPM	.0/ 1/ 0.		.1/ 14/ 0.	.2/ 13/ 0.		.1/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT	70.7/ 1/1.3026		88.3/ 14/ .8273	60.1/ 1/1.1036		87.9/ 14/ .8182
CO2 BCKGRD METER/RANGE/PCT	2.6/ 1/ .0459		13.1/ 14/ .0442	2.7/ 1/ .0476		12.7/ 14/ .0426
NOX SAMPLE METER/RANGE/PPM	41.2/ 2/ 41.2		44.0/ 1/ 11.0	27.1/ 2/ 27.2		45.8/ 1/ 11.5
NOX BCKGRD METER/RANGE/PPM	.0/ 2/ .0		.4/ 1/ .1	.1/ 2/ .1		.4/ 1/ .1
DILUTION FACTOR	9.96		16.29	12.09		16.47
THC CONCENTRATION PPM	102.		2.	17.		2.
CO CONCENTRATION PPM	482.		59.	183.		58.
CO2 CONCENTRATION PCT	1.2614		.7858	1.0599		.7781
NOX CONCENTRATION PPM	41.2		10.9	27.1		11.4
THC MASS GRAMS	4.37		.15	.71		.13
CO MASS GRAMS	41.89		8.79	15.88		8.58
CO2 MASS GRAMS	1724.2		1843.7	1448.0		1825.0
NOX MASS GRAMS	5.85		2.66	3.84		2.77
THC GRAMS/MI	1.23		.04	.20		.03
CO GRAMS/MI	11.78		2.30	4.45		2.21
CO2 GRAMS/MI	484.7		482.8	405.4		471.0
NOX GRAMS/MI	1.64		.70	1.07		.72
FUEL ECONOMY IN MPG	17.86	18.25	18.62	21.93	20.35	19.09
RUN TIME SECONDS	505.		867.	505.		867.
MEASURED DISTANCE MI	3.56	7.38	3.82	3.57	7.45	3.87
SCF, DRY	.969	.971	.973	.970	.972	.973
DFC, WET (DRY)		.924(.906)			.931(.913)	
TOT VOL (SCM) / SAM BLR (SCM)		202.8/ .00			202.7/ .00	

MPOSITE RESULTS

TEST NUMBER		516
BAROMETER	MM HG	739.1
HUMIDITY	G/KG	10.5
TEMPERATURE	DEG C	22.2

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	461.9	(458.5)
FUEL ECONOMY	MPG	19.25	(19.39)
HYDROCARBONS (THC)	G/MI	.33	(.33)
CARBON MONOXIDE	G/MI	4.86	(4.83)
OXIDES OF NITROGEN	G/MI	1.00	(1.00)

TABLE C-68

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                              FTP   - VEHICLE EMISSIONS RESULTS -
                                     PROJECT 08-2809-001

TEST NO.   521          RUN                 VEHICLE NO.                             TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE               DATE    5/28/90                         ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
ENGINE 3.0 L(183. CID)  -6                  BAG CART NO. 2 / CVS NO.  2             GASOLINE  EM-906-F
TRANSMISSION A3                             DYNO NO.      3                         ODOMETER  18733. KM( 11640. MILES)

BAROMETER 735.58 MM HG(28.96 IN HG)         DRY BULB TEMP. 22.2 DEG C(72.0 DEG F)
RELATIVE HUMIDITY  57. PCT                  ABS. HUMIDITY  9.9 GM/KG                NOX HUMIDITY CORRECTION FACTOR   .97
BAG RESULTS
  BAG NUMBER                                      1                  2                   3                   4
  DESCRIPTION                              COLD TRANSIENT       STABILIZED          HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)            762.0 (30.0)        762.0 (30.0)        762.0 (30.0)        762.0 (30.0)
  BLOWER INLET P MM. H2O(IN. H2O)          762.0 (30.0)        762.0 (30.0)        762.0 (30.0)        762.0 (30.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)         35.0 ( 95.0)        35.6 ( 96.0)        35.6 ( 96.0)        43.9 (111.0)
  BLOWER REVOLUTIONS                          40479.              69483.              40429.              69341.
  TOT FLOW STD. CU. METRES(SCF)             75.8 ( 2678.)      130.0 ( 4591.)       75.7 ( 2671.)      127.7 ( 4500.)
  THC SAMPLE METER/RANGE/PPM             65.9/   2/  65.     14.6/   2/  14.     21.1/   2/  21.     13.4/   2/  13.
  THC BCKGRD METER/RANGE/PPM             14.3/   2/  14.     14.8/   2/  15.     13.5/   2/  13.     11.7/   2/  12.
  CO  SAMPLE METER/RANGE/PPM             78.9/  14/ 380.     33.1/  12/  32.     84.6/  12/  85.     46.5/  12/  46.
  CO  BCKGRD METER/RANGE/PPM               .2/  14/   1.       .6/  12/   1.       .8/  12/   1.      3.3/  12/   3.
  CO2 SAMPLE METER/RANGE/PCT             67.8/   1/1.2480    89.0/  14/ .8434    60.8/   1/1.1167    87.5/  14/ .8092
  CO2 BCKGRD METER/RANGE/PCT              2.6/   1/ .0459    13.3/  14/ .0450     2.6/   1/ .0459    12.7/  14/ .0426
  NOX SAMPLE METER/RANGE/PPM             41.8/   2/ 41.8     62.1/   1/ 15.6     41.4/   2/ 41.4     56.7/   1/ 14.2
  NOX BCKGRD METER/RANGE/PPM               .1/   2/   .1       .5/   1/   .1       .2/   2/   .2       .2/   1/   .1
  DILUTION FACTOR                             10.30               15.68               11.80               16.32
  THC CONCENTRATION PPM                       52.                  1.                  9.                  2.
  CO  CONCENTRATION PPM                      363.                 31.                 80.                 41.
  CO2 CONCENTRATION PCT                      1.2066               .8013              1.0747               .7692
  NOX CONCENTRATION PPM                      41.7                15.4                41.2                14.2
  THC MASS GRAMS                              2.39                 .06                 .39                 .18
  CO  MASS GRAMS                             32.09                4.65                7.09                6.14
  CO2 MASS GRAMS                            1675.6              1907.5              1480.7              1798.0
  NOX MASS GRAMS                              5.89                3.74                5.81                3.37

  THC  GRAMS/MI                               .66                 .01                 .11                 .05
  CO   GRAMS/MI                              8.90                1.20                1.97                1.58
  CO2  GRAMS/MI                             464.9               491.5               412.9               464.3
  NOX  GRAMS/MI                              1.63                 .96                1.61                 .87
  FUEL ECONOMY IN MPG                       17.67      17.43    17.22               20.41      19.20    18.20
  RUN TIME              SECONDS             505.                868.                505.                867.
  MEASURED DISTANCE     MI                   3.60       7.49     3.88                3.61       7.48     3.87
  SCF, DRY                                   .969       .972     .973                .971       .973     .974
       DFC, WET (DRY)                               .924( .907)                            .930( .913)
       TOT VOL (SCM) / SAM BLR (SCM)                205.9/   .00                           203.3/   .00

COMPOSITE RESULTS                                                                              3-BAG      (4-BAG
  TEST NUMBER         521                                   CARBON DIOXIDE        G/MI         464.4      ( 456.4
  BAROMETER    MM HG  735.6                                 FUEL ECONOMY          MPG          18.09      ( 18.40
  HUMIDITY     G/KG     9.9                                 HYDROCARBONS (THC)    G/MI           .17      (   .18
  TEMPERATURE  DEG C   22.2                                 CARBON MONOXIDE       G/MI          3.00      (  3.12
                                                            OXIDES OF NITROGEN    G/MI          1.28      (  1.25
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TABLE C-69

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

FTP - VEHICLE EMISSIONS RESULTS -

PROJECT 08-2809-001

TEST NO. 522 RUN	VEHICLE NO.	TEST WEIGHT 1701. KG(3750. LBS)
VEHICLE MODEL 90 FORD PROBE	DATE 5/29/90	ACTUAL ROAD LOAD 6.0 KW(8.1 HP)
ENGINE 3.0 L(183. CID) -6	BAG CART NO. 2 / CVS NO. 2	GASOLINE EM-906-F
TRANSMISSION A3	DYNO NO. 3	ODOMETER 18763. KM(11659. MILES)
BAROMETER 736.09 MM HG(28.98 IN HG)	DRY BULB TEMP. 22.8 DEG C(73.0 DEG F)	
RELATIVE HUMIDITY 65. PCT	ABS. HUMIDITY 11.7 GM/KG	NOX HUMIDITY CORRECTION FACTOR 1.03

BAG RESULTS

BAG NUMBER	1		2	3		4
DESCRIPTION	COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)	774.7 (30.5)		774.7 (30.5)	774.7 (30.5)		774.7 (30.5)
BLOWER INLET P MM. H2O(IN. H2O)	774.7 (30.5)		774.7 (30.5)	774.7 (30.5)		774.7 (30.5)
BLOWER INLET TEMP. DEG. C(DEG. F)	42.8 (109.0)		42.2 (108.0)	42.2 (108.0)		42.2 (108.0)
BLOWER REVOLUTIONS	40535.		69493.	40485.		69450.
TOT FLOW STD. CU. METRES(SCF)	74.7 (2638.)		128.2 (4527.)	74.7 (2637.)		128.1 (4524.)
THC SAMPLE METER/RANGE/PPM	69.6/ 2/ 69.		12.9/ 2/ 13.	20.6/ 2/ 20.		12.7/ 2/ 13.
THC BCKGRD METER/RANGE/PPM	10.9/ 2/ 11.		11.0/ 2/ 11.	11.4/ 2/ 11.		10.7/ 2/ 11.
CO SAMPLE METER/RANGE/PPM	72.3/ 14/ 342.		47.9/ 12/ 47.	71.8/ 12/ 71.		48.3/ 12/ 48.
CO BCKGRD METER/RANGE/PPM	.1/ 14/ 0.		.6/ 12/ 1.	.6/ 12/ 1.		2.1/ 12/ 2.
CO2 SAMPLE METER/RANGE/PCT	73.5/ 1/1.3555		87.6/ 14/ .8114	59.9/ 1/1.0999		86.6/ 14/ .7894
CO2 BCKGRD METER/RANGE/PCT	2.4/ 1/ .0423		12.7/ 14/ .0426	2.6/ 1/ .0459		12.6/ 14/ .0422
NOX SAMPLE METER/RANGE/PPM	59.0/ 2/ 59.0		63.2/ 1/ 15.8	37.6/ 2/ 37.6		52.2/ 1/ 13.1
NOX BCKGRD METER/RANGE/PPM	.2/ 2/ .2		.5/ 1/ .1	.2/ 2/ .2		.4/ 1/ .1
DILUTION FACTOR	9.53		16.27	11.99		16.72
THC CONCENTRATION PPM	59.		3.	10.		3.
CO CONCENTRATION PPM	326.		45.	68.		44.
CO2 CONCENTRATION PCT	1.3176		.7714	1.0578		.7497
NOX CONCENTRATION PPM	58.8		15.7	37.4		13.0
THC MASS GRAMS	2.66		.20	.45		.20
CO MASS GRAMS	28.33		6.70	5.89		6.56
CO2 MASS GRAMS	1802.2		1810.6	1446.4		1758.5
NOX MASS GRAMS	8.69		3.99	5.53		3.29
THC GRAMS/MI	.74		.05	.13		.05
CO GRAMS/MI	7.87		1.75	1.64		1.70
CO2 GRAMS/MI	500.8		471.8	402.2		456.8
NOX GRAMS/MI	2.42		1.04	1.54		.86
FUEL ECONOMY IN MPG	16.48	17.19	17.90	20.97	19.61	18.49
RUN TIME SECONDS	505.		868.	506.		867.
MEASURED DISTANCE MI	3.60	7.44	3.84	3.60	7.45	3.85
SCF. DRY	.966	.969	.971	.968	.970	.971
DFC, WET (DRY)		.923(.903)			.932(.912)	
TOT VOL (SCM) / SAM BLR (SCM)		202.9/ .00			202.8/ .00	

MPOSITE RESULTS

TEST NUMBER		522
BAROMETER	MM HG	736.1
HUMIDITY	G/KG	11.7
TEMPERATURE	DEG C	22.8

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	458.7	(454.3)
FUEL ECONOMY	MPG	18.31	(18.49)
HYDROCARBONS (THC)	G/MI	.21	(.21)
CARBON MONOXIDE	G/MI	2.99	(2.98)
OXIDES OF NITROGEN	G/MI	1.46	(1.41)

TABLE C-70

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          SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                       FTP   - VEHICLE EMISSIONS RESULTS -
                           PROJECT 08-2809-001

TEST NO.   523          RUN                 VEHICLE NO.                          TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE               DATE    5/30/90                      ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
ENGINE 3.0 L(183. CID)  V6                  BAG CART NO. 2 / CVS NO.  2          GASOLINE  EM-906-F
TRANSMISSION A3                             DYNO NO.      3                      ODOMETER  18794. KM( 11678. MILES)

BAROMETER 735.08 MM HG(28.94 IN HG)         DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  62. PCT                  ABS. HUMIDITY 11.5 GM/KG             NOX HUMIDITY CORRECTION FACTOR  1.03
BAG RESULTS
  BAG NUMBER                                      1                  2                  3                  4
  DESCRIPTION                              COLD TRANSIENT       STABILIZED        HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             787.4 (31.0)       787.4 (31.0)       762.0 (30.0)       762.0 (30.0)
  BLOWER INLET P MM. H2O(IN. H2O)           787.4 (31.0)       787.4 (31.0)       762.0 (30.0)       762.0 (30.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)          41.1 (106.0)       41.1 (106.0)       42.8 (109.0)       41.7 (107.0)
  BLOWER REVOLUTIONS                          40413.             69505.             40460.             69429.
  TOT FLOW STD. CU. METRES(SCF)             74.5 ( 2629.)      128.0 ( 4521.)      74.6 ( 2634.)     128.2 ( 4528.)
  THC SAMPLE METER/RANGE/PPM               73.2/   2/  72.    12.8/   2/  13.    20.9/   2/  21.    14.0/   2/  14.
  THC BCKGRD METER/RANGE/PPM               11.1/   2/  11.    11.2/   2/  11.    11.0/   2/  11.    11.4/   2/  11.
  CO  SAMPLE METER/RANGE/PPM               66.8/  14/ 312.    38.5/  12/  38.    49.4/  13/ 115.    62.6/  12/  62.
  CO  BCKGRD METER/RANGE/PPM                1.2/  14/   5.     3.7/  12/   4.     1.0/  13/   2.     2.1/  12/   2.
  CO2 SAMPLE METER/RANGE/PCT               72.8/   1/1.3423   88.4/  14/ .8295   59.3/   1/1.0886   86.6/  14/ .7894
  CO2 BCKGRD METER/RANGE/PCT                2.8/   1/ .0494   12.9/  14/ .0434    2.5/   1/ .0441   12.8/  14/ .0430
  NOX SAMPLE METER/RANGE/PPM               58.2/   2/ 58.2    65.8/   1/ 16.5    32.4/   2/ 32.4    50.0/   1/ 12.5
  NOX BCKGRD METER/RANGE/PPM                 .3/   2/   .3      .7/   1/   .2      .2/   2/   .2      .4/   1/   .1
  DILUTION FACTOR                              9.64              15.94              12.07              16.69
  THC CONCENTRATION PPM                        63.                2.                11.                 3.
  CO  CONCENTRATION PPM                       293.               33.               109.                58.
  CO2 CONCENTRATION PCT                      1.2980             .7889             1.0482              .7490
  NOX CONCENTRATION PPM                       57.9               16.3               32.3               12.4
  THC MASS GRAMS                              2.80                .18                .48                .25
  CO  MASS GRAMS                             25.38               4.94               9.43               8.65
  CO2 MASS GRAMS                            1769.3             1849.3             1431.4             1758.6
  NOX MASS GRAMS                              8.47               4.10               4.73               3.13

  THC  GRAMS/MI                                .77                .04                .13                .07
  CO   GRAMS/MI                               7.03               1.27               2.65               2.27
  CO2  GRAMS/MI                              489.7              474.2              402.0              461.5
  NOX  GRAMS/MI                               2.34               1.05               1.33                .82
  FUEL ECONOMY IN MPG                        16.89      17.37   17.84              20.90      19.45   18.26
  RUN TIME              SECONDS              504.               867.               505.               867.
  MEASURED DISTANCE     MI                   3.61       7.51    3.90               3.56       7.37    3.81
  SCF, DRY                                   .967       .970    .972               .969       .971    .972
     DFC, WET (DRY)                               .922( .904)                           .932( .913)
     TOT VOL (SCM) / SAM BLR (SCM)               202.5/   .00                          202.8/   .00

COMPOSITE RESULTS                                                                               3-BAG      (4-BAG)
  TEST NUMBER         523                                  CARBON DIOXIDE         G/MI         457.8      ( 453.8)
  BAROMETER    MM HG  735.1                                FUEL ECONOMY           MPG          18.36      ( 18.50)
  HUMIDITY     G/KG    11.5                                HYDROCARBONS (THC)     G/MI           .22      (   .23)
  TEMPERATURE  DEG C   23.3                                CARBON MONOXIDE        G/MI          2.83      (  3.13)
                                                           OXIDES OF NITROGEN     G/MI          1.39      (  1.33)
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           SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                         FTP   - VEHICLE EMISSIONS RESULTS -
                                PROJECT 08-2809-001

TEST NO.   531          RUN   :
VEHICLE MODEL    90 FORD PROBE           VEHICLE NO.
ENGINE 3.0 L(183. CID)  -6               DATE    6/ 5/90                  TEST WEIGHT  1701. KG( 3750. LBS)
TRANSMISSION A3                          BAG CART NO. 2 / CVS NO.  2      ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
                                         DYNO NO.      3                  GASOLINE  EM-907-F
                                                                          ODOMETER  18968. KM( 11786. MILES)

BAROMETER 739.39 MM HG(29.11 IN HG)      DRY BULB TEMP. 22.8 DEG C(73.0 DEG F)
RELATIVE HUMIDITY  61. PCT               ABS. HUMIDITY 11.0 GM/KG
BAG RESULTS                                                               NOX HUMIDITY CORRECTION FACTOR  1.01
   BAG NUMBER                                  1                 2                 3                 4
   DESCRIPTION                           COLD TRANSIENT     STABILIZED      HOT TRANSIENT      STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)          774.7 (30.5)     774.7 (30.5)     772.2 (30.4)     764.5 (30.1)
   BLOWER INLET P MM. H2O(IN. H2O)        774.7 (30.5)     774.7 (30.5)     769.6 (30.3)     762.0 (30.0)
   BLOWER INLET TEMP. DEG. C(DEG. F)       42.8 (109.0)     41.7 (107.0)     43.3 (110.0)     41.1 (106.0)
   BLOWER REVOLUTIONS                       40603.           69477.           40439.           69384.
   TOT FLOW STD. CU. METRES(SCF)           75.2 ( 2656.)   128.9 ( 4553.)    74.9 ( 2644.)   129.1 ( 4559.)
   THC SAMPLE METER/RANGE/PPM            75.2/  2/ 74.    14.3/  2/ 14.    22.7/  2/ 22.    11.7/  2/ 12.
   THC BCKGRD METER/RANGE/PPM            12.3/  2/ 12.    12.1/  2/ 12.    11.7/  2/ 12.     9.8/  2/ 10.
   CO  SAMPLE METER/RANGE/PPM            78.4/ 14/ 378.   47.6/ 12/ 47.    91.4/ 12/ 92.    41.4/ 12/ 41.
   CO  BCKGRD METER/RANGE/PPM              .0/ 14/   0.     .2/ 12/   0.     .5/ 12/   0.     .6/ 12/   1.
   CO2 SAMPLE METER/RANGE/PCT            66.3/  1/1.2199  86.8/ 14/ .7938  58.8/  1/1.0793  86.7/ 14/ .7916
   CO2 BCKGRD METER/RANGE/PCT             2.7/  1/ .0476  12.8/ 14/ .0430   2.5/  1/ .0441  12.6/ 14/ .0422
   NOX SAMPLE METER/RANGE/PPM            43.4/  2/ 43.4   54.6/  1/ 13.7   35.4/  2/ 35.4   59.5/  1/ 14.9
   NOX BCKGRD METER/RANGE/PPM              .2/  2/   .2     .6/  1/   .2     .2/  2/   .2     .6/  1/   .2
   DILUTION FACTOR                           10.42            16.46            12.07            16.52
   THC CONCENTRATION PPM                     63.              3.               12.              2.
   CO  CONCENTRATION PPM                     361.             45.              88.              39.
   CO2 CONCENTRATION PCT                     1.1768           .7534            1.0388           .7519
   NOX CONCENTRATION PPM                     43.2             13.5             35.2             14.8
   THC MASS GRAMS                            2.86             .22              .53              .19
   CO  MASS GRAMS                            31.60            6.76             7.63             5.81
   CO2 MASS GRAMS                            1620.5           1778.5           1424.0           1777.5
   NOX MASS GRAMS                            6.27             3.37             5.09             3.68

   THC  GRAMS/MI                             .80              .06              .15              .05
   CO   GRAMS/MI                             8.82             1.77             2.11             1.51
   CO2  GRAMS/MI                             452.4            465.2            393.9            462.2
   NOX  GRAMS/MI                             1.75             .88              1.41             .96
   FUEL ECONOMY IN MPG                       18.09     18.10  18.11            21.32     19.61  18.24
   RUN TIME            SECONDS               505.             867.             505.             867.
   MEASURED DISTANCE   MI                    3.58      7.41   3.82             3.62      7.46   3.85
   SCF, DRY                                  .968      .971   .972             .969      .971   .972
      DFC, WET (DRY)                             .926( .908)                       .931( .913)
      TOT VOL (SCM) / SAM BLR (SCM)              204.2/   .00                      204.0/   .00

OSITE RESULTS
 TEST NUMBER         531                                                    3-BAG      (4-BAG)
 BAROMETER    MM HG  739.4             CARBON DIOXIDE          G/MI         442.8      ( 441.9)
 HUMIDITY     G/KG    11.0             FUEL ECONOMY            MPG          18.89      ( 18.93)
 TEMPERATURE  DEG C   22.8             HYDROCARBONS (THC)      G/MI           .24      (   .23)
                                       CARBON MONOXIDE         G/MI          3.33      (  3.25)
                                       OXIDES OF NITROGEN      G/MI          1.21      (  1.23)
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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                  FTP   - VEHICLE EMISSIONS RESULTS -
                                         PROJECT 08-2809-001

TEST NO.   532          RUN              VEHICLE NO.                          TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE            DATE    6/ 6/90                      ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
ENGINE 3.0 L(183. CID) -6                BAG CART NO. 2 / CVS NO. 2           GASOLINE  EM-907-F
TRANSMISSION A3                          DYNO NO.      3                      ODOMETER  18997. KM( 11804. MILES)

BAROMETER 738.89 MM HG(29.09 IN HG)      DRY BULB TEMP. 25.0 DEG C(77.0 DEG F)
RELATIVE HUMIDITY  60. PCT               ABS. HUMIDITY 12.2 GM/KG             NOX HUMIDITY CORRECTION FACTOR  1.05
BAG RESULTS
   BAG NUMBER                                  1                  2                  3                   4
   DESCRIPTION                          COLD TRANSIENT       STABILIZED        HOT TRANSIENT        STABILIZED

   BLOWER DIF P MM. H2O(IN. H2O)         769.6 (30.3)       769.6 (30.3)       769.6 (30.3)        769.6 (30.3)
   BLOWER INLET P MM. H2O(IN. H2O)       767.1 (30.2)       767.1 (30.2)       767.1 (30.2)        767.1 (30.2)
   BLOWER INLET TEMP. DEG. C(DEG. F)      42.8 (109.0)       41.1 (106.0)       41.7 (107.0)        41.7 (107.0)
   BLOWER REVOLUTIONS                      40503.             69481.             40436.              69434.
   TOT FLOW STD. CU. METRES(SCF)         75.0 ( 2650.)      129.1 ( 4559.)      75.1 ( 2650.)       128.9 ( 4551.)
   THC SAMPLE METER/RANGE/PPM          81.4/   2/  81.    13.3/   2/  13.    21.6/   2/  21.     12.0/   2/  12.
   THC BCKGRD METER/RANGE/PPM          11.3/   2/  11.    11.4/   2/  11.    11.0/   2/  11.     10.1/   2/  10.
   CO  SAMPLE METER/RANGE/PPM          38.8/  14/ 438.    46.6/  12/  46.    48.0/  13/ 112.     51.4/  12/  51.
   CO  BCKGRD METER/RANGE/PPM            .8/  14/   3.     2.2/  12/   2.      .5/  13/   1.       .3/  12/   0.
   CO2 SAMPLE METER/RANGE/PCT          68.4/   1/1.2593   86.8/  14/ .7938   58.5/   1/1.0737    86.7/  14/ .7916
   CO2 BCKGRD METER/RANGE/PCT           2.4/   1/ .0423   12.6/  14/ .0422    2.4/   1/ .0423    12.6/  14/ .0422
   NOX SAMPLE METER/RANGE/PPM          42.8/   2/ 42.8    56.2/   1/ 14.1    33.5/   2/ 33.5     57.1/   1/ 14.3
   NOX BCKGRD METER/RANGE/PPM            .3/   2/   .3      .6/   1/   .2      .1/   2/   .1       .5/   1/   .1
   DILUTION FACTOR                          10.05              16.46              12.11               16.50
   THC CONCENTRATION PPM                    70.                 3.                11.                  2.
   CO  CONCENTRATION PPM                   416.                42.               106.                 49.
   CO2 CONCENTRATION PCT                   1.2212             .7541              1.0348              .7519
   NOX CONCENTRATION PPM                   42.5               13.9               33.4                14.2
   THC MASS GRAMS                          3.17                .20                .51                 .19
   CO  MASS GRAMS                         36.34               6.36               9.30                7.30
   CO2 MASS GRAMS                        1677.8             1782.6             1422.1              1774.3
   NOX MASS GRAMS                          6.42               3.62               5.05                3.68

   THC  GRAMS/MI                            .89                .05                .14                 .05
   CO   GRAMS/MI                          10.21               1.66               2.60                1.88
   CO2  GRAMS/MI                          471.5              464.7              397.3               457.2
   NOX  GRAMS/MI                           1.80                .94               1.41                 .95
   FUEL ECONOMY IN MPG                    17.29     17.72     18.13              21.09     19.61     18.42
   RUN TIME              SECONDS          505.                867.               505.                868.
   MEASURED DISTANCE     MI                3.56      7.39      3.84               3.58      7.46      3.88
   SCF, DRY                                .968      .971      .973               .970      .972      .973
        DFC, WET (DRY)                           .925( .907)                           .931( .913)
        TOT VOL (SCM) / SAM BLR (SCM)            204.2/   .00                          203.9/   .00

COMPOSITE RESULTS                                                                      3-BAG       (4-BAG
   TEST NUMBER        532                                   CARBON DIOXIDE      G/MI    447.6       ( 445.5
   BAROMETER     MM HG  738.9                               FUEL ECONOMY        MPG     18.66       ( 18.75
   HUMIDITY      G/KG    12.2                               HYDROCARBONS (THC)  G/MI      .25       (   .25
   TEMPERATURE   DEG C   25.0                               CARBON MONOXIDE     G/MI     3.69       (  3.75
                                                            OXIDES OF NITROGEN  G/MI     1.25       (  1.25
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              SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                          FTP   - VEHICLE EMISSIONS RESULTS -
                                PROJECT 08-2809-001

TEST NO.   533          RUN              VEHICLE NO.
VEHICLE MODEL   90 FORD PROBE            DATE     6/ 7/90                    TEST WEIGHT  1701. KG( 3750. LBS)
ENGINE 3.0 L(183. CID)  -6               BAG CART NO. 2 / CVS NO.  2         ACTUAL ROAD LOAD   6.0 KW(  8.1 HP)
TRANSMISSION A3                          DYNO NO.      3                     GASOLINE  EM-907-F
                                                                             ODOMETER  19027. KM( 11823. MILES)

BAROMETER 739.65 MM HG(29.12 IN HG)      DRY BULB TEMP. 23.3 DEG C(74.0 DEG F)
RELATIVE HUMIDITY  66. PCT               ABS. HUMIDITY 12.2 GM/KG            NOX HUMIDITY CORRECTION FACTOR  1.05
BAG RESULTS
  BAG NUMBER                                   1                  2                  3                  4
  DESCRIPTION                           COLD TRANSIENT       STABILIZED        HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)          767.1 (30.2)       769.6 (30.3)       769.6 (30.3)       769.6 (30.3)
  BLOWER INLET P MM. H2O(IN. H2O)        764.5 (30.1)       767.1 (30.2)       767.1 (30.2)       767.1 (30.2)
  BLOWER INLET TEMP. DEG. C(DEG. F)       43.3 (110.0)       42.8 (109.0)       43.3 (110.0)       41.1 (106.0)
  BLOWER REVOLUTIONS                       40437.             69507.             40438.             69420.
  TOT FLOW STD. CU. METRES(SCF)           75.0 ( 2647.)     128.9 ( 4552.)      74.9 ( 2645.)     129.1 ( 4560.)
  THC SAMPLE METER/RANGE/PPM          77.1/   2/  76.    13.2/   2/  13.    20.8/   2/  21.    12.2/   2/  12.
  THC BCKGRD METER/RANGE/PPM          11.4/   2/  11.    11.5/   2/  11.    10.7/   2/  11.    10.0/   2/  10.
  CO  SAMPLE METER/RANGE/PPM          83.7/  14/ 408.    49.9/  12/  49.    42.7/  13/  99.    72.5/  12/  72.
  CO  BCKGRD METER/RANGE/PPM            .0/  14/   0.      .0/  12/   0.      .0/  13/   0.      .5/  12/   0.
  CO2 SAMPLE METER/RANGE/PCT          72.8/   1/1.3423   88.4/  14/ .8295   58.8/   1/1.0793   87.0/  14/ .7982
  CO2 BCKGRD METER/RANGE/PCT           2.4/   1/ .0423   12.4/  14/ .0415    2.5/   1/ .0441   12.9/  14/ .0434
  NOX SAMPLE METER/RANGE/PPM          57.3/   2/ 57.3    54.8/   1/ 13.7    32.1/   2/ 32.1    52.7/   1/ 13.2
  NOX BCKGRD METER/RANGE/PPM            .2/   2/   .2      .2/   1/   .1      .2/   2/   .2      .5/   1/   .1
  DILUTION FACTOR                           9.48              15.75              12.07              16.32
  THC CONCENTRATION PPM                     66.                2.                11.                 3.
  CO  CONCENTRATION PPM                    389.               47.                95.                69.
  CO2 CONCENTRATION PCT                    1.3044             .7907             1.0388              .7574
  NOX CONCENTRATION PPM                    57.1               13.7               32.0               13.1
  THC MASS GRAMS                            2.98               .19                .49                .22
  CO  MASS GRAMS                           33.93              7.10               8.28              10.36
  CO2 MASS GRAMS                          1790.1            1866.2             1425.0             1790.7
  NOX MASS GRAMS                            8.59              3.54               4.81               3.39

  THC  GRAMS/MI                              .82               .05                .14                .06
  CO   GRAMS/MI                             9.40              1.81               2.32               2.67
  CO2  GRAMS/MI                            496.1             477.0              399.0              461.6
  NOX  GRAMS/MI                             2.38               .91               1.35                .87
  FUEL ECONOMY IN MPG                      16.51     17.09    17.66              21.03     19.45    18.19
  RUN TIME              SECONDS            504.               868.               505.               868.
  MEASURED DISTANCE     MI                  3.61      7.52     3.91               3.57      7.45     3.88
  SCF, DRY                                  .965      .969     .971               .968      .970     .971
       DFC, WET (DRY)                              .921( .901)                          .931( .911)
       TOT VOL (SCM) / SAM BLR (SCM)              203.9/   .00                         204.1/   .00

COMPOSITE RESULTS
  TEST NUMBER         533                                                           3-BAG       (4-BAG)
  BAROMETER    MM HG  739.6                  CARBON DIOXIDE         G/MI            459.7      ( 455.0)
  HUMIDITY     G/KG    12.2                  FUEL ECONOMY           MPG             18.19      ( 18.36)
  TEMPERATURE  DEG C   23.3                  HYDROCARBONS (THC)     G/MI              .23      (   .23)
                                             CARBON MONOXIDE        G/MI             3.52      (  3.77)
                                             OXIDES OF NITROGEN     G/MI             1.33      (  1.32)
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TABLE C-74

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                    SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                                  FTP   - VEHICLE EMISSIONS RESULTS -
                                        PROJECT 08-2809-001

TEST NO.   541          RUN                   VEHICLE NO.                            TEST WEIGHT  1701. KG( 3750. LBS
VEHICLE MODEL   90 FORD PROBE                 DATE    6/11/90                        ACTUAL ROAD LOAD   6.0 KW(  8.1
ENGINE 3.0 L(183. CID)  -6                    BAG CART NO. 2 / CVS NO.  2            GASOLINE  EM-908-F
TRANSMISSION A3                               DYNO NO.       3                       ODOMETER  19156. KM( 11903. MILE

BAROMETER 743.20 MM HG(29.26 IN HG)           DRY BULB TEMP. 24.4 DEG C(76.0 DEG F)
RELATIVE HUMIDITY  59. PCT                    ABS. HUMIDITY 11.6 GM/KG               NOX HUMIDITY CORRECTION FACTOR
BAG RESULTS
  BAG NUMBER                                        1                  2                  3                  4
  DESCRIPTION                                 COLD TRANSIENT       STABILIZED       HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)                800.1 (31.5)       797.6 (31.4)       800.1 (31.5)       795.0 (31.3)
  BLOWER INLET P MM. H2O(IN. H2O)              800.1 (31.5)       795.0 (31.3)       800.1 (31.5)       792.5 (31.2)
  BLOWER INLET TEMP. DEG. C(DEG. F)             43.3 (110.0)       41.7 (107.0)       43.3 (110.0)       42.8 (109.0)
  BLOWER REVOLUTIONS                             40511.             69480.             40404.             69404.
  TOT FLOW STD. CU. METRES(SCF)                 75.1 ( 2652.)     129.3 ( 4565.)      74.9 ( 2645.)     128.9 ( 45
  THC SAMPLE METER/RANGE/PPM                 77.5/   2/  77.    13.1/   2/  13.     23.2/   2/  23.    12.1/   2/
  THC BCKGRD METER/RANGE/PPM                 11.0/   2/  11.    11.1/   2/  11.     10.4/   2/  10.     9.6/   2/
  CO  SAMPLE METER/RANGE/PPM                 93.3/  14/ 465.    59.2/  12/  59.     58.3/  13/ 138.    68.5/  12/
  CO  BCKGRD METER/RANGE/PPM                   .1/  14/   0.      .6/  12/   1.       .2/  13/   0.      .6/  12/
  CO2 SAMPLE METER/RANGE/PCT                 66.3/   1/1.2199   87.2/  14/ .8026    58.1/   1/1.0662   86.4/  14/
  CO2 BCKGRD METER/RANGE/PCT                  2.5/   1/ .0441   12.8/  14/ .0430     2.6/   1/ .0459   12.9/  14/
  NOX SAMPLE METER/RANGE/PPM                 31.9/   2/ 31.9    48.8/   1/ 12.2     26.7/   2/ 26.8    47.8/   1/
  NOX BCKGRD METER/RANGE/PPM                   .1/   2/   .1      .5/   1/   .1       .3/   2/   .3      .5/   1/
  DILUTION FACTOR                                 10.38              16.31              12.21              16.65
  THC CONCENTRATION PPM                           67.                 3.                14.                 3.
  CO  CONCENTRATION PPM                          444.                56.               132.                65.
  CO2 CONCENTRATION PCT                          1.1800              .7622             1.0241              .7443
  NOX CONCENTRATION PPM                          31.9               12.1               26.5               11.9
  THC MASS GRAMS                                  3.01                .21                .61                .24
  CO  MASS GRAMS                                 38.84               8.42              11.49               9.77
  CO2 MASS GRAMS                                1622.7             1804.1             1404.4             1756.9
  NOX MASS GRAMS                                  4.71               3.09               3.91               3.01

  THC  GRAMS/MI                                    .04                .05                .17                .06
  CO   GRAMS/MI                                  10.83               2.18               3.24               2.53
  CO2  GRAMS/MI                                  452.4              466.3              395.8              454.2
  NOX  GRAMS/MI                                   1.31                .80               1.10                .78
  FUEL ECONOMY IN MPG                            17.93     17.97    18.01              21.00     19.63    18.46
  RUN TIME                 SECONDS               506.               868.               505.               868.
  MEASURED DISTANCE        MI                     3.59      7.46     3.87               3.55      7.42     3.87
  SCF, DRY                                         .969      .972     .973               .970      .972     .973
       DFC, WET (DRY)                                   .926( .908)                          .932( .914)
       TOT VOL (SCM) / SAM BLR (SCM)                   204.4/   .00                          203.8/   .00

COMPOSITE RESULTS
   TEST NUMBER          541                                                                          3-BAG      (
   BAROMETER    MM HG  743.2                                   CARBON DIOXIDE       G/MI           444.2      (
   HUMIDITY     G/KG     11.6                                  FUEL ECONOMY         MPG             18.74      (
   TEMPERATURE  DEG C    24.4                                  HYDROCARBONS (THC)   G/MI              .25      (
                                                               CARBON MONOXIDE      G/MI             4.26      (
                                                               OXIDES OF NITROGEN   G/MI              .99      (
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TABLE C-75

SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH

FTP - VEHICLE EMISSIONS RESULTS -

PROJECT 08-2809-001

TEST NO. 542 RUN	VEHICLE NO.	
VEHICLE MODEL 90 FORD PROBE	DATE 6/12/90	TEST WEIGHT 1701. KG(3750. LBS)
ENGINE 3.0 L(183. CID) -6	BAG CART NO. 2 / CVS NO. 2	ACTUAL ROAD LOAD 6.0 KW(8.1 HP)
TRANSMISSION A3	DYNO NO. 3	GASOLINE EM-908-F
		ODOMETER 19185. KM(11921. MILES)
BAROMETER 740.66 MM HG(29.16 IN HG)	DRY BULB TEMP. 22.8 DEG C(73.0 DEG F)	
RELATIVE HUMIDITY 61. PCT	ABS. HUMIDITY 10.9 GM/KG	NOX HUMIDITY CORRECTION FACTOR 1.01

BAG RESULTS

BAG NUMBER		1		2	3		4
DESCRIPTION		COLD TRANSIENT		STABILIZED	HOT TRANSIENT		STABILIZED
BLOWER DIF P MM. H2O(IN. H2O)		787.4 (31.0)		787.4 (31.0)	787.4 (31.0)		784.9 (30.9)
BLOWER INLET P MM. H2O(IN. H2O)		787.4 (31.0)		787.4 (31.0)	787.4 (31.0)		782.3 (30.8)
BLOWER INLET TEMP. DEG. C(DEG. F)		41.7 (107.0)		42.2 (108.0)	42.8 (109.0)		42.8 (109.0)
BLOWER REVOLUTIONS		40484.		69467.	40397.		69306.
TOT FLOW STD. CU. METRES(SCF)		75.1 (2653.)		128.8 (4548.)	74.8 (2642.)		128.4 (4535.)
THC SAMPLE METER/RANGE/PPM		86.5/ 2/ 86.		13.7/ 2/ 14.	23.6/ 2/ 23.		13.3/ 2/ 13.
THC BCKGRD METER/RANGE/PPM		12.7/ 2/ 13.		12.4/ 2/ 12.	11.4/ 2/ 11.		11.7/ 2/ 12.
CO SAMPLE METER/RANGE/PPM		88.6/ 14/ 437.		53.0/ 12/ 52.	58.9/ 13/ 139.		55.2/ 12/ 54.
CO BCKGRD METER/RANGE/PPM		.1/ 14/ 0.		.1/ 12/ 0.	.0/ 13/ 0.		.5/ 12/ 0.
CO2 SAMPLE METER/RANGE/PCT		69.3/ 1/1.2763		87.4/ 14/ .8070	58.8/ 1/1.0793		86.7/ 14/ .7916
CO2 BCKGRD METER/RANGE/PCT		2.7/ 1/ .0476		13.1/ 14/ .0442	2.6/ 1/ .0459		13.2/ 14/ .0446
NOX SAMPLE METER/RANGE/PPM		43.8/ 2/ 43.8		49.5/ 1/ 12.4	28.9/ 2/ 29.0		54.9/ 1/ 13.8
NOX BCKGRD METER/RANGE/PPM		.4/ 2/ .4		.7/ 1/ .2	.0/ 2/ .0		1.2/ 1/ .3
DILUTION FACTOR		9.95		16.23	12.06		16.54
THC CONCENTRATION PPM		74.		2.	13.		2.
CO CONCENTRATION PPM		417.		50.	133.		52.
CO2 CONCENTRATION PCT		1.2334		.7655	1.0372		.7497
NOX CONCENTRATION PPM		43.4		12.2	29.0		13.5
THC MASS GRAMS		3.34		.16	.58		.18
CO MASS GRAMS		36.48		7.54	11.62		7.79
CO2 MASS GRAMS		1696.7		1005.0	1420.7		1762.9
NOX MASS GRAMS		6.29		3.04	4.17		3.33
THC GRAMS/MI		.94		.04	.16		.05
CO GRAMS/MI		10.22		1.97	3.24		2.02
CO2 GRAMS/MI		475.6		470.6	396.2		457.8
NOX GRAMS/MI		1.76		.79	1.16		.87
FUEL ECONOMY IN MPG		17.12	17.49	17.86	21.06	19.57	18.35
RUN TIME	SECONDS	505.		868.	505.		867.
MEASURED DISTANCE	MI	3.57	7.40	3.84	3.59	7.44	3.85
SCF, DRY		.968	.971	.972	.970	.971	.972
DFC, WET (DRY)			.924(.906)			.931(.913)	
TOT VOL (SCM) / SAM BLR (SCM)			203.9/ .00			203.3/ .00	

COMPOSITE RESULTS

TEST NUMBER		542
BAROMETER	MM HG	740.7
HUMIDITY	G/KG	10.9
TEMPERATURE	DEG C	22.8

		3-BAG	(4-BAG)
CARBON DIOXIDE	G/MI	451.1	(447.4
FUEL ECONOMY	MPG	18.47	(18.62
HYDROCARBONS (THC)	G/MI	.26	(.26
CARBON MONOXIDE	G/MI	4.03	(4.05
OXIDES OF NITROGEN	G/MI	1.10	(1.12

TABLE C-76

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                 SOUTHWEST RESEARCH INSTITUTE - DEPARTMENT OF EMISSIONS RESEARCH
                             FTP   - VEHICLE EMISSIONS RESULTS -
                                  PROJECT 08-2809-001

TEST NO.   543           RUN                VEHICLE NO.                            TEST WEIGHT  1701. KG( 3750. LBS)
VEHICLE MODEL   90 FORD PROBE               DATE    6/13/90                        ACTUAL ROAD LOAD   6.0 KW(  8.1 H
ENGINE 3.0 L(183. CID)  ->                  BAG CART NO. 2 / CVS NO.  2            GASOLINE  EM-908-F
TRANSMISSION A3                             DYNO NO.       3                       ODOMETER  19214. KM( 11939. MILES

BAROMETER 739.14 MM HG(29.10 IN HG)         DRY BULB TEMP. 22.8 DEG C(73.0 DEG F)
RELATIVE HUMIDITY  65. PCT                  ABS. HUMIDITY 11.7 GM/KG               NOX HUMIDITY CORRECTION FACTOR  1
BAG RESULTS
  BAG NUMBER                                      1                  2                   3                  4
  DESCRIPTION                               COLD TRANSIENT       STABILIZED         HOT TRANSIENT        STABILIZED

  BLOWER DIF P MM. H2O(IN. H2O)             787.4 (31.0)        787.4 (31.0)        787.4 (31.0)        787.4 (31.0)
  BLOWER INLET P MM. H2O(IN. H2O)           787.4 (31.0)        787.4 (31.0)        767.4 (31.0)        787.4 (31.0)
  BLOWER INLET TEMP. DEG. C(DEG. F)          42.2 (108.0)        42.8 (109.0)        42.8 (109.0)        42.8 (109.0)
  BLOWER REVOLUTIONS                           40522.              69427.              40404.              69368.
  TOT FLOW STD. CU. METRES(SCF)              75.0 ( 2647.)      128.3 ( 4530.)       74.7 ( 2636.)      128.2 ( 452
  THC SAMPLE METER/RANGE/PPM              11.9/   3/ 119.    12.6/   2/  12.    20.5/   2/  20.    12.1/   2/
  THC BCKGRD METER/RANGE/PPM               1.1/   3/  11.    10.6/   2/  10.     9.5/   2/   9.    10.2/   2/
  CO  SAMPLE METER/RANGE/PPM              56.5/   1/ 494.    52.8/  12/  52.    59.2/  13/ 140.    65.2/  12/
  CO  BCKGRD METER/RANGE/PPM                .0/   1/   0.      .7/  12/   1.      .0/  13/   0.      .5/  12/
  CO2 SAMPLE METER/RANGE/PCT              67.5/   1/1.2424   87.5/  14/ .8092   59.3/   1/1.0886   86.5/  14/ .
  CO2 BCKGRD METER/RANGE/PCT               2.5/   1/ .0441   12.9/  14/ .0434    2.6/   1/ .0459   12.8/  14/ .
  NOX SAMPLE METER/RANGE/PPM              38.7/   2/ 38.7    55.0/   1/ 13.8    30.6/   2/ 30.6    46.9/   1/ 1
  NOX BCKGRD METER/RANGE/PPM                .2/   2/   .2     1.2/   1/   .3      .5/   2/   .5      .8/   1/
  DILUTION FACTOR                              10.15               16.19               11.96               16.61
  THC CONCENTRATION PPM                        109.                3.                  12.                 2.
  CO  CONCENTRATION PPM                        472.                50.                 134.                62.
  CO2 CONCENTRATION PCT                        1.2027              .7685               1.0466              .7468
  NOX CONCENTRATION PPM                        38.5                13.5                30.2                11.6
  THC MASS GRAMS                               4.89                .20                 .52                 .19
  CO  MASS GRAMS                               41.16               7.40                11.65               9.22
  CO2 MASS GRAMS                               1650.5              1805.0              1430.6              1752.6
  NOX MASS GRAMS                               5.71                3.42                4.45                2.93

  THC  GRAMS/MI                                1.36                .05                 .15                 .05
  CO   GRAMS/MI                                11.46               1.91                3.24                2.39
  CO2  GRAMS/MI                                459.6               466.1               398.3               454.0
  NOX  GRAMS/MI                                1.59                .88                 1.24                .76
  FUEL ECONOMY IN MPG                          17.57      17.81    18.04               20.96      19.60    18.48
  RUN TIME             SECONDS                 506.                867.                505.                867.
  MEASURED DISTANCE    MI                      3.59       7.46     3.87                3.59       7.45     3.86
  SCF, DRY                                     .967       .969     .971                .968       .970     .971
      DFC, WET (DRY)                                .925( .905)                             .931( .912)
      TOT VOL (SCM) / SAM BLR (SCM)                203.3/   .00                            202.8/   .00

COMPOSITE RESULTS                                                                                  3-BAG      (
  TEST NUMBER          543                                        CARBON DIOXIDE      G/MI       446.1      (
  BAROMETER    MM HG   739.1                                      FUEL ECONOMY        MPG        18.65      (
  HUMIDITY     G/KG    11.7                                       HYDROCARBONS (THC)  G/MI        .35       (
  TEMPERATURE  DEG C   22.8                                       CARBON MONOXIDE     G/MI       4.25       (
                                                                  OXIDES OF NITROGEN  G/MI       1.13       (
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APPENDIX D

UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS FROM FIVE TEST VEHICLES OPERATED WITH FOUR FUELS

	Table
1974 Chevrolet Impala	D-1
1977 Mercury Marquis	D-2
1983 Buick Regal	D-3
1990 Chevrolet Lumina	D-4
1990 Ford Probe	D-5

TABLE D-1. 1974 CHEVROLET IMPALA UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	Baseline Fuel (EM-905-F) Exhaust Emissions, mg/mi									10% Ethanol (EM-906-F) Exhaust Emissions, mg/mi					
	411	412	413	414	415	416	Avg.	S.D.	C.V.,%	421	422	423	Avg.	S.D.	C.V.,%
Ethylene	805	755	641	686	687	700	712	58	8.1	722	850	831	801	69	8.6
1,3-Butadiene	68.4	61.9	58.4	64.8	63.5	45.6	60.4	8.0	13.3	61.1	69.5	73.5	68.0	6.3	9.3
Isobutylene	146	137	122	130	138	126	133	9	6.8	136	154	160	150	13	8.7
Benzene	a	466	392	419	409	418	421	28	6.5	306	332	359	332	27	8.1
Toluene	a	1103	898	1022	939	967	986	80	8.1	469	508	518	489	28	5.7
m-, p-Xylenes	557	482	384	429	450	416	453	61	13.5	228	240	265	245	19	7.8
o-Xylene	253	207	171	184	213	200	205	28	13.7	89.1	95.5	104	96.2	7.5	7.8
Oxygenated HC and N_2O															
Formaldehyde	97.2	72.3	79.1	84.2	83.6	88.3	84.1	8.4	10.0	86.8	56.9	97.1	80.3	20.9	26.0
Acetaldehyde	18.3	16.4	20.1	20.0	21.5	22.9	19.9	2.3	11.6	25.0	19.9	31.9	25.6	6.0	23.5
Total Aldehydes & Ketones	180	131	146	162	139	155	152	18	11.8	158	102	173	144	37	25.7
Ethanol	ND[b]	ND	Trace[c]	Trace	Trace	ND	ND	--	--	45.5	42.0	47.0	44.8	2.6	5.7
MTBE	3.0	2.7	ND	ND	Trace	ND	1.0	1.5	148	ND	ND	ND	ND	--	--
N_2O	15.0	6.1	14.6	28.1	Trace	16.0	16.0	7.9	49.2	32.2	5.7	10.0	16.0	14.2	88.9
	Evaporative Emissions, mg/test									**Evaporative Emissions, mg/test**					
MTBE	ND	ND	ND	21	ND	ND	4	9	225	ND	ND	ND	ND	--	--
Benzene	68	93	76	90	67	a	79	12	15.4	68	87	64	73	12	16.9
Ethanol	ND	Trace	66	ND	ND	ND	11	27	246	202	384	253	280	94	33.6

TABLE D-1 (CONT'D). 1974 CHEVROLET IMPALA UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	16.4% MTBE (EM-907-F) Exhaust Emissions, mg/mi						19.1% ETBE (EM-908-F) Exhaust Emissions, mg/mi					
	431	432	433	Avg.	S.D.	C.V.,%	441	442	443	Avg.	S.D.	C.V.,%
Ethylene	520	658	659	612	80	13.1	600	710	689	666	58	8.7
1,3-Butadiene	53.9	56.8	64.0	58.2	5.2	8.9	57.9	70.9	55.7	61.5	8.2	13.4
Isobutylene	218	250	252	240	19	7.9	233	250	268	250	17	6.8
Benzene	207	258	254	240	28	11.7	214	228	258	234	22	9.4
Toluene	293	376	368	346	46	13.3	306	293	351	317	30	9.5
m-, p-Xylenes	160	178	184	174	13	7.5	149	165	182	165	16	9.7
o-Xylene	61.5	65.0	67.2	64.6	2.9	4.4	59.6	61.5	67.3	62.8	4.0	6.4
Oxygenated HC and N_2O												
Formaldehyde	101	109	90.7	100	9.1	9.2	88.8	84.6	92.3	88.6	3.9	4.4
Acetaldehyde	21.7	23.9	20.2	21.9	1.9	8.5	47.8	49.4	51.8	49.7	2.0	4.1
Total Aldehydes & Ketones	180	182	150	171	18	10.5	183	179	192	185	7	3.8
Ethanol	Trace	Trace	Trace	Trace	--	--	73.5	42.7	87.3	67.8	22.8	33.7
MTBE	122	135	142	133	10	7.5	ND	ND	ND	ND	--	--
N_2O	14.5	17.1	12.7	14.8	2.2	15.0	19.3	12.2	Trace	10.4	9.7	93.7
	Evaporative Emissions, mg/test						**Evaporative Emissions, mg/test**					
MTBE	717	841	774	777	62	8.0	ND	ND	ND	ND	--	--
Benzene	67	81	67	72	8	11.3	79	98	55	77	22	28.0
Ethanol	19	ND	28	16	14	87.5	12	Trace	Trace	4	7	175

[a] No data.
[b] ND - Not detected. Less than the detection limit.
[c] Trace - Detected but not quantifiable above the detection limit.

TABLE D-2. 1977 MERCURY MARQUIS UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	Baseline Fuel (EM-905-F) Exhaust Emissions, mg/mi										10% Ethanol (EM-906-F) Exhaust Emissions, mg/mi					
	211	212	213	214	215	216	215R[a]	Avg.	S.D.	C.V.,%	221	222	223	Avg.	S.D.	C.V.,%
Ethylene	56.4	50.8	53.5	55.8	50.8	50.8	51.3	52.8	2.5	4.7	59.7	56.3	58.6	58.2	1.7	3.0
1,3-Butadiene	b	1.9	1.5	1.3	1.1	1.2	1.1	1.4	0.3	22.0	2.4	2.0	1.3	1.9	0.6	29.3
Isobutylene	b	7.9	7.2	8.5	9.4	8.2	7.6	8.1	0.8	9.5	9.4	9.2	7.9	8.8	0.8	9.3
Benzene	17.9	21.5	15.8	17.0	18.3	14.1	16.2	17.3	2.3	13.3	16.4	13.1	10.2	13.2	3.1	23.5
Toluene	47.4	64.1	59.3	52.0	44.2	38.9	52.9	51.3	8.7	16.9	28.0	23.2	20.2	23.8	3.9	16.5
m-, p-Xylenes	24.6	25.8	30.1	22.1	20.1	22.1	26.5	24.5	3.4	13.7	15.1	15.1	12.9	14.4	1.3	8.8
o-Xylene	11.7	13.1	14.5	10.7	9.2	10.9	12.9	11.9	1.8	14.9	9.5	7.4	7.3	8.1	1.2	15.3
Oxygenated HC and N_2O																
Formaldehyde	31.4	34.0	39.3	37.5	23.2	24.7	b	31.7	6.6	20.8	42.5	47.0	43.7	44.4	2.3	5.3
Acetaldehyde	10.4	11.2	14.0	11.3	9.3	9.2	b	10.9	1.8	16.2	22.2	23.1	21.9	22.4	0.6	2.8
Total Aldehydes & Ketones	49.3	61.0	72.0	65.7	40.8	49.4	b	56.4	11.8	20.9	81.7	92.3	78.6	84.2	7.2	8.5
Ethanol	ND[c]	ND	ND	ND	ND	ND	ND	ND	--	--	4[d]	2[d]	2[d]	3	1	43
MTBE	ND	ND	ND	10.4	ND	ND	ND	1.5	3.9	262	ND	ND	ND	ND	--	--
N_2O	b	8.1	10.2	13.9	10.6	9.1	8.1	10.0	2.2	21.7	7.2	12.0	14.3	11.2	3.6	32.3
	Evaporative Emissions, mg/test										Evaporative Emissions, mg/test					
MTBE	ND	ND	ND	409	ND	ND	b	68	167	246	ND	ND	ND	ND	--	--
Benzene	134	121	135	116	94	92	b	115	19	16.4	257	298	222	259	38	14.7
Ethanol	ND	ND	581	49	30	30	b	115	229	199	1820	1820	790	1500	600	39.9

TABLE D-2 (CONT'D). 1977 MERCURY MARQUIS UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	16.4% MTBE (EM-907-F) Exhaust Emissions, mg/mi						19.1% ETBE (EM-908-F) Exhaust Emissions, mg/mi					
	231	232	233	Avg.	S.D.	C.V.,%	241	242	243	Avg.	S.D.	C.V.,%
Ethylene	52.2	62.1	62.3	58.9	5.8	9.8	69.8	69.3	69.8	69.6	0.3	0.4
1,3-Butadiene	1.6	2.0	1.6	1.7	0.2	13.6	1.8	1.9	2.1	1.9	0.2	8.0
Isobutylene	29.8	38.6	32.5	33.6	4.5	13.4	21.6	35.4	30.2	29.1	7.0	24.0
Benzene	11.8	13.5	12.5	12.6	0.8	6.8	14.2	18.8	11.0	14.7	3.9	26.7
Toluene	21.4	24.1	21.6	22.4	1.5	6.7	25.5	25.5	16.6	22.5	5.1	22.8
m-, p-Xylenes	11.3	11.6	10.7	11.2	0.5	4.1	14.4	15.4	12.2	14.0	1.6	11.7
o-Xylene	5.7	6.1	5.5	5.8	0.3	5.3	6.9	8.9	6.1	7.3	1.4	19.8
Oxygenated HC and N_2O												
Formaldehyde	67.8	53.9	70.5	64.1	8.9	13.9	55.2	57.7	52.7	55.2	2.5	4.5
Acetaldehyde	16.0	12.0	14.9	14.3	2.0	14.5	33.0	39.0	33.7	35.2	3.3	0.1
Total Aldehydes & Ketones	112	87.3	113	104	15	14.0	114.6	127.7	108.5	116.9	9.8	8.4
Ethanol	ND	ND	ND	ND	--	--	ND	ND	ND	ND	--	--
MTBE	16.2	25.4	31.9	24.5	7.9	32.2	ND	ND	ND	ND	--	--
N_2O	14.1	13.3	12.9	13.4	0.6	4.6	8.8	11.8	12.3	11.0	1.9	17.2
	Evaporative Emissions, mg/test						Evaporative Emissions, mg/test					
MTBE	1428	2518	2027	1991	546	27.4	ND	ND	ND	ND	--	--
Benzene	144	138	181	154	23	15.1	130	142	129	134	7	5.4
Ethanol	368	208	69	215	150	69.6	ND	10	ND	ND	3	175

[a] Repeat of Test 5.
[b] No data.
[c] ND - Not detected. Less than the detection limit.
[d] Estimated values due to acetonitrile interference.

TABLE D-3. 1983 BUICK REGAL UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	Baseline Fuel (EM-905-F) Exhaust Emissions, mg/mi									10% Ethanol (EM-906-F) Exhaust Emissions, mg/mi					
	311	312	313	314	315	316	Avg.	S.D.	C.V.,%	321	322	323	Avg.	S.D.	C.V.,%
Ethylene	36.8	37.2	36.7	37.7	43.7	33.9	37.7	3.2	8.5	35.6	31.5	43.7	37.2	6.1	16.4
1,3-Butadiene	1.3	1.3	1.1	1.3	1.7	1.1	1.3	0.2	15.4	0.8	1.0	1.5	1.1	0.4	36.4
Isobutylene	6.2	5.6	5.7	6.1	6.9	5.7	6.0	0.5	8.3	5.5	5.4	6.3	5.8	0.5	8.6
Benzene	22.1	26.2	26.3	27.0	33.2	25.0	26.6	3.7	13.7	19.8	18.2	25.6	21.2	3.9	18.4
Toluene	66.1	82.0	76.2	76.3	96.5	69.6	77.8	10.7	13.8	29.9	27.7	38.7	32.1	5.8	18.1
m-, p-Xylenes	28.7	39.4	31.6	31.3	41.0	31.2	33.9	5.0	14.8	15.5	15.5	21.4	17.5	3.4	19.5
o-Xylene	13.3	17.5	13.8	14.5	18.3	15.9	15.6	2.0	13.1	6.5	7.3	9.3	7.7	1.4	18.7
Oxygenated HC and N_2O															
Formaldehyde	5.0	5.4	4.3	4.4	7.7	6.6	5.6	1.3	23.9	6.1	5.0	6.6	5.9	0.8	13.6
Acetaldehyde	1.6	2.1	2.6	2.5	1.9	3.2	2.3	0.6	24.8	7.5	7.1	6.4	7.0	0.6	8.6
Total Aldehydes & Ketones	8.2	9.5	10.3	9.9	11.6	9.7	9.9	1.1	11.2	16.1	13.7	18.5	16.1	2.4	14.9
Ethanol	ND[a]	ND	ND	ND	ND	ND	ND	--	--	c	25.6	28.7	27.2	--	--
MTBE	ND	ND	ND	Trace[b]	Trace	Trace	Trace	--	--	ND	ND	ND	ND	--	--
N_2O	248	198	252	223	235	231	231	20	8.7	211	244	244	233	19	8.2
	Evaporative Emissions, mg/test									**Evaporative Emissions, mg/test**					
MTBE	ND	ND	ND	41	6	ND	8	16	200	ND	ND	ND	ND	--	--
Benzene	46	47	51	55	44	58	50	6	12.0	54	55	67	59	7	11.9
Ethanol	34	24	Trace	ND	ND	ND	10	15	150	304	374	222	300	76	25.3

TABLE D-3 (CONT'D). 1983 BUICK REGAL UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	16.4% MTBE (EM-907-F) Exhaust Emissions, mg/mi						19.1% ETBE (EM-908-F) Exhaust Emissions, mg/mi					
	331	332	333	Avg.	S.D.	C.V.,%	341	342	343	Avg.	S.D.	C.V.,%
Ethylene	32.5	37.1	32.9	34.2	2.6	7.6	38.0	39.8	37.7	38.5	1.1	2.9
1,3-Butadiene	0.7	1.0	0.8	0.8	0.2	25.0	1.0	1.2	1.1	1.1	0.1	9.1
Isobutylene	15.0	16.5	17.2	16.2	1.1	6.8	16.6	17.5	17.5	17.2	0.5	2.9
Benzene	17.3	20.2	17.0	18.2	1.8	9.7	17.0	19.3	16.2	17.5	1.6	9.1
Toluene	24.8	25.7	20.1	23.5	3.0	12.7	24.3	33.0	19.7	25.7	6.8	26.3
m-, p-Xylenes	11.6	11.7	9.3	10.9	1.4	12.5	11.4	15.0	11.3	12.6	2.1	16.7
o-Xylene	5.9	5.6	4.7	5.4	0.6	11.6	4.9	6.6	5.1	5.5	0.9	16.4
Oxygenated HC and N_2O												
Formaldehyde	4.2	4.6	6.8	5.2	1.4	26.9	2.3	7.6	5.9	5.3	2.7	51.1
Acetaldehyde	1.8	2.1	2.5	2.1	0.4	19.0	3.7	5.8	5.8	5.1	1.2	23.8
Total Aldehydes & Ketones	6.8	7.6	11.9	8.8	2.7	31.2	10.1	17.0	13.9	13.7	3.5	25.2
Ethanol	ND	ND	ND	ND	--	--	ND	ND	ND	ND	--	--
MTBE	20.7	22.4	18.9	20.7	1.8	8.5	Trace	Trace	ND	Trace	--	--
N_2O	240	237	241	239	2	0.8	223	223	224	223	1	0.3
	Evaporative Emissions, mg/test						**Evaporative Emissions, mg/test**					
MTBE	146	163	204	171	30	17.5	15	Trace	18	11	10	90.9
Benzene	46	47	39	44	4	9.1	41	35	35	37	4	10.8
Ethanol	26	ND	12	13	13	108	12	Trace	Trace	4	7	175

[a] ND - Not detected. Less than the detection limit.

[b] Trace - Detected but not quantifiable above the detection limit.

[c] No data.

TABLE D-4. 1990 CHEVROLET LUMINA UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

	Baseline Fuel (EM-905-F) Exhaust Emissions, mg/mi									10% Ethanol (EM-906-F) Exhaust Emissions, mg/mi					
Speciated HC	**111**	**112**	**113**	**114**	**115**	**116**	**Avg.**	**S.D.**	**C.V.,%**	**121**	**122**	**123**	**Avg.**	**S.D.**	**C.V.,%**
Ethylene	12.3	14.1	13.0	13.9	14.6	14.0	13.7	0.8	6.1	12.2	13.9	13.4	13.2	0.9	6.6
1,3-Butadiene	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.04	5.1	0.8	0.7	0.8	0.8	0.1	7.2
Isobutylene	3.1	3.3	2.9	3.4	3.7	3.3	3.3	0.3	8.2	2.5	3.0	3.2	2.9	0.4	12.4
Benzene	11.6	10.5	10.6	10.6	8.8	11.8	10.7	1.1	10.0	5.1	6.7	6.4	6.1	0.8	13.9
Toluene	22.0	24.3	25.5	21.6	22.5	25.0	23.5	1.7	7.1	11.8	9.6	6.3	9.2	2.8	30.1
m-, p-Xylenes	6.3	10.7	8.7	8.2	8.7	10.7	8.9	1.7	18.7	4.0	2.6	3.5	3.4	0.7	20.9
o-Xylene	2.9	5.0	4.0	3.6	3.9	4.8	4.0	0.8	19.4	1.8	Trace[a]	1.6	1.1	1.0	87.3
Oxygenated HC and N_2O															
Formaldehyde	2.0	3.4	3.5	3.3	3.1	3.2	3.1	0.6	17.7	4.0	3.7	4.7	4.1	0.5	12.5
Acetaldehyde	1.3	1.0	1.4	0.9	2.6	1.1	1.4	0.6	44.6	1.2	3.5	3.1	2.6	1.2	47.3
Total Aldehydes & Ketones	4.8	5.8	7.0	6.2	7.0	5.7	6.1	0.8	13.8	7.0	8.9	10.1	8.7	1.6	18.0
Ethanol	ND[b]	ND	ND	ND	ND	ND	ND	--	--	ND	ND	ND	ND	--	--
MTBE	ND	ND	ND	ND	ND	ND	ND	--	--	ND	ND	ND	ND	--	--
N_2O	53.6	29.8	64.3	42.1	33.0	31.6	42.4	13.9	32.8	29.9	37.3	46.9	38.0	8.5	22.4
	Evaporative Emissions, mg/test									**Evaporative Emissions, mg/test**					
MTBE	ND	ND	ND	ND	ND	ND	ND	--	--	ND	ND	ND	ND	--	--
Benzene	10	12	10	11	7	16	11	3	27.0	13	17	14	15	2	13.9
Ethanol	ND	ND	30	ND	ND	ND	5	12	245	21	40	60	40	20	48

TABLE D-4 (CONT'D). 1990 CHEVROLET LUMINA UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	16.4% MTBE (EM-907-F) Exhaust Emissions, mg/mi						19.1% ETBE (EM-908-F) Exhaust Emissions, mg/mi					
	131	132	133	Avg.	S.D.	C.V.,%	141	142	143	Avg.	S.D.	C.V.,%
Ethylene	12.1	12.2	13.7	12.7	0.9	7.1	14.6	14.4	14.5	14.5	0.1	0.7
1,3-Butadiene	0.8	0.7	0.9	0.8	0.1	12.5	1.0	1.1	1.0	1.0	0.1	5.8
Isobutylene	6.6	7.3	7.8	7.2	0.6	8.4	7.9	8.5	8.0	8.1	0.3	4.0
Benzene	5.9	6.3	5.6	5.9	0.4	6.0	8.2	8.4	8.1	8.2	0.2	1.9
Toluene	10.3	6.2	8.9	8.5	2.1	24.6	10.8	10.0	11.6	10.8	0.8	7.4
m-, p-Xylenes	3.9	3.1	4.2	3.7	0.6	15.2	5.2	4.6	5.7	5.2	0.6	10.6
o-Xylene	1.9	1.5	1.8	1.7	0.2	12.0	2.4	2.5	2.6	2.5	0.1	4.0
Oxygenated HC and N_2O												
Formaldehyde	4.2	4.1	4.6	4.3	0.3	6.2	3.8	5.0	4.2	4.3	0.6	14.2
Acetaldehyde	1.1	1.5	1.1	1.2	0.2	18.8	2.5	2.7	2.6	2.6	0.1	3.8
Total Aldehydes & Ketones	7.6	7.0	7.8	7.5	0.4	5.6	8.8	9.3	9.3	9.1	0.3	3.2
Ethanol	ND	ND	ND	ND	--	--	ND	ND	ND	ND	--	--
MTBE	Trace	4.5	7.9	4.1	4.0	96.0	ND	ND	ND	ND	--	--
N_2O	35.9	50.5	50.5	45.5	8.3	18.2	28.7	30.2	50.3	36.4	12.1	33.1
	Evaporative Emissions, mg/test						**Evaporative Emissions, mg/test**					
MTBE	39	46	27	37	10	25.8	ND	ND	ND	ND	--	--
Benzene	11	18	3	11	8	68.2	13	11	15	13	2	15.4
Ethanol	ND	ND	ND	ND	--	--	ND	ND	ND	ND	--	--

[a] Trace - Detected but not quantifiable above the detection limit.
[b] ND - Not detected. Less than the detection limit.

TABLE D-5. 1990 FORD PROBE UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

	Baseline Fuel (EM-905-F) Exhaust Emissions, mg/mi									10% Ethanol (EM-906-F) Exhaust Emissions, mg/mi							
Speciated HC	**511**	**512**	**513**	**514**	**515**	**516**	**Avg.**	**S.D.**	**C.V.,%**	**521**	**522**	**523**	**524**	**525**	**Avg.**	**S.D.**	**C.V.,%**
Ethylene	9.4	11.3	12.5	13.0	14.4	15.3	12.7	2.1	16.8	10.2	10.6	10.5	a	a	10.4	0.2	2.0
1,3-Butadiene	0.5	0.7	0.7	1.1	0.9	1.4	0.9	0.3	36.1	0.5	0.7	0.8	a	a	0.7	0.2	21.8
Isobutylene	2.8	3.0	3.3	3.8	4.2	4.4	3.6	0.6	18.1	2.5	3.5	2.9	a	a	3.0	0.5	16.8
Benzene	12.9	11.1	14.6	15.8	15.2	14.4	14.0	1.7	12.3	7.1	9.5	7.4	a	a	8.0	1.3	16.4
Toluene	34.4	31.3	37.0	34.6	38.7	47.0	37.2	5.4	14.6	16.6	13.2	12.5	a	a	14.1	2.2	15.6
m-, p-Xylenes	20.6	20.3	19.0	19.9	21.9	29.0	21.8	3.7	16.8	7.0	8.5	9.9	a	a	8.5	1.5	17.1
o-Xylene	8.2	8.9	8.3	9.4	10.6	b	9.1	1.0	10.8	3.5	4.0	4.6	a	a	4.0	0.6	13.8
Oxygenated HC and N_2O																	
Formaldehyde	4.8	3.0	3.0	1.4	3.6	3.9	3.3	1.1	34.5	4.9	3.4	3.2	a	a	3.8	0.9	24.4
Acetaldehyde	1.2	0.5	0.7	0.3	1.0	1.0	0.8	0.3	42.9	2.5	1.7	2.3	a	a	2.2	0.4	18.9
Total Aldehydes & Ketones	6.1	3.8	4.0	2.1	5.5	5.6	4.5	1.5	33.4	8.0	5.5	5.7	a	a	6.4	1.4	21.7
Ethanol	ND[c]	ND	ND	ND	Trace[d]	ND	Trace	--	--	7.6	9.2	8.7	a	a	8.5	0.8	9.6
MTBE	ND	ND	ND	Trace	ND	ND	Trace	--	--	ND	ND	ND	a	a	ND	--	--
N_2O	64.0	61.5	80.9	88.3	70.9	80.3	74.3	10.6	14.2	62.8	61.7	75.1	a	a	66.5	7.4	11.2
	Evaporative Emissions, mg/test									**Evaporative Emissions, mg/test**							
MTBE	ND	ND	ND	6	ND	ND	Trace	--	--	e	e	e	ND	ND	ND	--	--
Benzene	16	b	21	23	7	11	16	7	42	e	e	e	20	16	18	--	--
Ethanol	25	ND	37	11	ND	ND	12	16	131	e	e	e	92	132	112	--	--

TABLE D-5 (CONT'D). 1990 FORD PROBE UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS

Speciated HC	16.4% MTBE (EM-907-F) Exhaust Emissions, mg/mi						19.1% ETBE (EM-908-F) Exhaust Emissions, mg/mi					
	531	532	533	Avg.	S.D.	C.V.,%	541	542	543	Avg.	S.D.	C.V.,%
Ethylene	11.1	12.3	10.4	11.3	1.0	8.5	11.5	12.4	13.3	12.4	0.9	7.3
1,3-Butadiene	0.7	0.9	0.6	0.7	0.2	21.8	0.8	1.0	1.0	0.9	0.1	12.8
Isobutylene	8.5	9.3	8.6	8.8	0.4	5.0	9.3	10.1	11.0	10.1	0.8	8.4
Benzene	8.9	8.7	7.8	8.5	0.6	6.9	8.0	10.2	10.4	9.5	1.3	14.0
Toluene	14.8	13.3	12.8	13.6	1.0	7.6	14.8	14.2	20.7	16.6	3.6	21.6
m-, p-Xylenes	8.4	10.8	8.0	9.1	1.5	16.6	8.7	8.8	12.2	9.9	2.0	20.1
o-Xylene	3.3	4.4	3.1	3.6	0.7	19.4	3.3	3.6	4.6	3.8	0.7	17.9
Oxygenated HC and N_2O												
Formaldehyde	1.9	1.7	1.7	1.8	0.1	6.4	3.4	3.3	3.4	3.4	0.1	1.7
Acetaldehyde	0.3	0.3	0.2	0.3	0.1	19.3	1.8	1.5	2.2	1.8	0.4	19.5
Total Aldehydes & Ketones	2.4	3.1	3.2	2.9	0.4	15.0	5.4	5.2	6.5	5.7	0.7	12.3
Ethanol	ND	ND	ND	ND	--	--	Trace	Trace	Trace	Trace	--	--
MTBE	5.4	6.2	7.5	6.4	1.1	16.6	ND	Trace	ND	ND	--	--
N_2O	80.4	88.5	81.7	83.5	4.4	5.2	59.0	79.9	80.4	73.1	12.2	16.7
	Evaporative Emissions, mg/test						**Evaporative Emissions, mg/test**					
MTBE	7	15	Trace	7	8	107	ND	ND	ND	ND	--	--
Benzene	12	7	11	10	3	26	23	9	17	16	7	44
Ethanol	14	14	15	14	1	4	ND	Trace	Trace	Trace	--	--

[a] Tests 524 and 525 conducted for regulated exhaust and evaporative emissions only - no speciated exhaust emissions.
[b] No data.
[c] ND - Not detected. Less than the detection limit.
[d] Trace - Detected but not quantifiable above the detection limit.
[e] No evaporative emissions - fuel leak.

APPENDIX E

NORMALIZATION OF SEVERAL UNREGULATED EMISSIONS

TABLE E-1. NORMALIZED UNREGULATED EXHAUST EMISSIONS BY TEST NUMBER FOR THE 1974 CHEVROLET IMPALA

Emission	Baseline Fuel Regression Statistics		Baseline Fuel (EM-905-F) Emissions, mg/mi								
	Slope Probability	r^2	411	412	413	414	415	416	Avg.	SD	CV,%
Acetaldehyde	0.01	83.4	20.4	18.2	20.4	18.9	19.0	20.1	19.5	0.9	4.8

Emissions	10% Ethanol (EM-906-F) Emissions, mg/mi						16.4% MTBE (EM-907-F) Emissions, mg/mi						19.1% ETBE (EM-908-F) Emissions, mg/mi					
	421	422	423	Avg.	SD	CV,%	431	432	433	Avg.	SD	CV,%	441	442	443	Avg.	SD	CV,%
Acetaldehyde	26.4	21.0	32.6	26.6	5.8	21.9	21.7	23.6	19.5	21.6	2.0	9.4	46.4	47.6	49.7	47.9	1.7	3.5

TABLE E-2. NORMALIZED UNREGULATED EXHAUST AND EVAPORATIVE EMISSIONS BY TEST NUMBER FOR THE 1977 MERCURY MARQUIS

Emission	Baseline Fuel Regression Statistics		Baseline Fuel (EM-905-F) Emissions, mg/mi, except as noted									
	Slope Probability	r^2	211	212	213	214	215	216	215R[a]	Avg.	S.D.	C.V.,%
1,3-Butadiene	0.00	92.2	a	1.6	1.4	1.4	1.4	1.6	1.5	1.5	0.1	5.8
Evaporative Benzene mg/test	0.02	77.8	117	107	132	124	113	114	a	118	9	7.5

Emissions	10% Ethanol (EM-906-F) Emissions, mg/mi, except as noted						16.4% MTBE (EM-907-F) Emissions, mg/mi						19.1% ETBE (EM-908-F) Emissions, mg/mi, except as noted					
	221	222	223	Avg.	SD	CV,%	231	232	233	Avg.	SD	CV,%	241	242	243	Avg.	SD	CV,%
1,3-Butadiene	2.1	1.8	1.1	1.7	0.5	29.8	1.6	2.0	1.6	1.7	0.2	13.7	2.0	2.1	2.4	2.2	0.2	9.6
Evaporative Benzene, mg/test	246	290	216	251	37	14.7	144	141	187	157	26	16.3	141	156	146	148	8	5.1

[a] No data.

TABLE E-3. NORMALIZED UNREGULATED EXHAUST EMISSIONS BY TEST NUMBER FOR THE 1990 FORD PROBE

	Baseline Fuel Regression Statistics		Baseline Fuel (EM-905-F) Emissions, mg/mi								
Emission	Slope Probability	r^2	511	512	513	514	515	516	Avg.	SD	CV,%
Ethylene	0.00	92.1	11.4	13.0	12.8	12.0	12.0	12.6	12.3	0.6	4.8
1,3-Butadiene	0.03	73.2	0.8	0.9	0.8	1.0	0.6	1.0	0.8	0.2	20.1
Isobutylene	0.00	99.3	3.4	3.5	3.4	3.5	3.4	3.5	3.5	0.0	1.5
o-Xylene	0.06	75.5	9.1	9.7	8.5	8.9	9.5	a	9.1	0.5	5.3

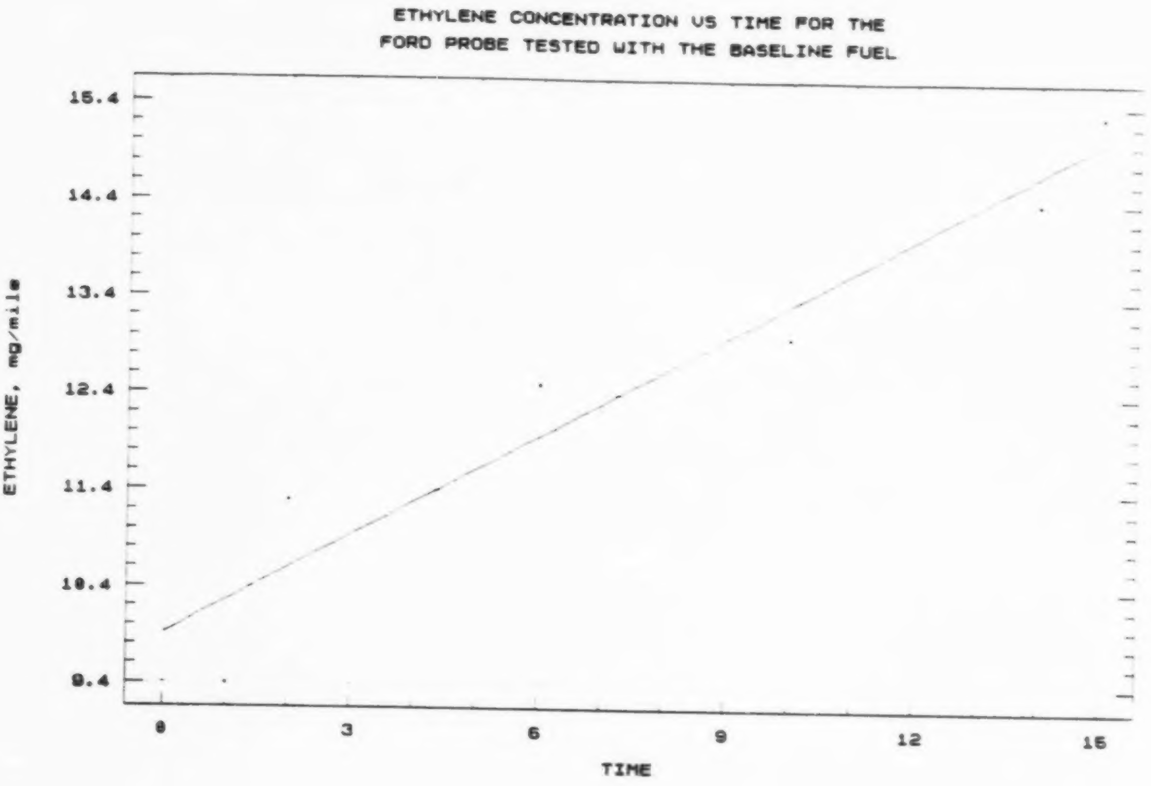
	10% Ethanol (EM-906-F) Emissions, mg/mi						16.4% MTBE (EM-907-F) Emissions, mg/mi						19.1% ETBE (EM-908-F) Emissions, mg/mi					
Emissions	521	522	523	Avg.	SD	CV,%	531	532	533	Avg.	SD	CV,%	541	542	543	Avg.	SD	CV,%
Ethylene	11.6	11.6	11.2	11.5	0.2	2.1	11.1	12.0	9.7	10.9	1.1	10.3	10.1	10.7	11.2	10.7	0.6	5.2
1,3-Butadiene	0.7	0.8	0.9	0.8	0.1	13.0	0.7	0.8	0.5	0.7	0.2	24.7	0.6	0.8	0.7	0.7	0.1	11.7
Isobutylene	2.9	3.8	3.1	3.3	0.5	14.3	8.5	9.2	8.4	8.7	0.4	5.0	8.9	9.6	10.4	9.6	0.7	7.8
o-Xylene	4.1	4.5	4.9	4.5	0.4	8.8	3.3	4.2	2.8	3.4	0.7	21.4	2.7	2.8	3.7	3.1	0.5	17.5

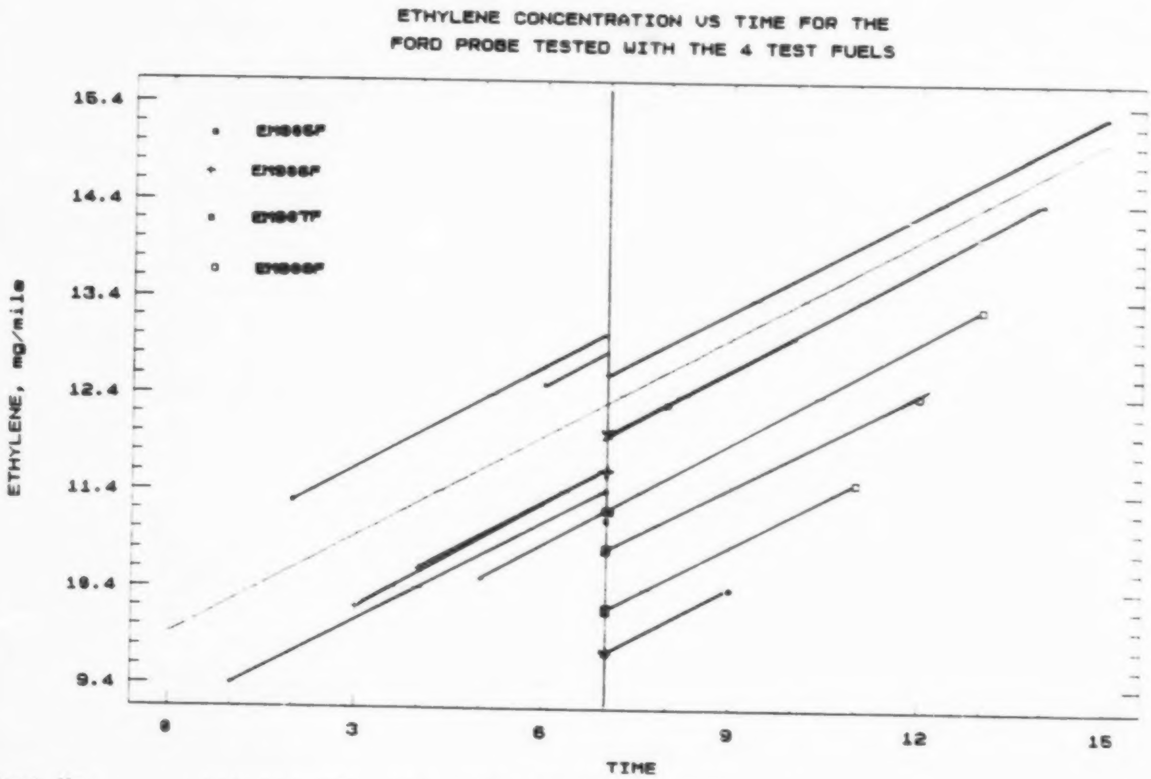
[a] No Data.

PROCEDURE FOR NORMALIZING UNREGULATED EMISSIONS

A linear regression analysis was performed on each unregulated emissions variable for each test vehicle operated with the baseline fuel, using test time as the predictor variable. The sequence in which the tests were performed allowed for bracketing of emissions data generated from testing with the blends with emissions data from testing with the baseline fuel. The test sequence is given in Table 15. Test time for each of the tests was assigned by the sequence in which the test was conducted. As shown in the figure, test times ranged from one through fifteen for the fifteen FTP tests. The first test on the Ford Probe, Test 511, was assigned a time of one. Each successive test, performed sequentially in order, was assigned test times from two to fifteen.

A simple linear regression equation relating the emission rate and time sequence of the individual tests provided the attained significance level for the slope coefficient of the line and the coefficient of determination, r^2. An attained significance level less than 0.06 (or, conversely a confidence level greater than 0.94) for the slope coefficient was the value set for determining if baseline fuel emissions were changing significantly with time. Lower significance levels for the slope coefficient indicate a greater likelihood that the slope is non-zero and that the emission rate is changing with time. In addition to significance level, a limit was set on the r^2 value as a measure of the goodness of fit of the regression equation. The minimum r^2 limit was 70 percent, as a break in the data appeared at about this point. In the sample statistical summary provided, the slope significance level is given along with the appropriate r^2 value (in percent). The individual non-normalized emission rates were adjusted (i.e., normalized) by multiplying the estimated slope from the fitted regression line by the difference in the time at which the test was conducted from the approximate time midpoint, 7, and then adding this increment to the normalized emission rates. For example, the first ethanol blend test in the sequence of tests for the Probe, test 521, was conducted at time 3 (of 15 tests). The difference in time from 7 is 4. The estimated slope of the fitted drift line was multiplied by 4 and added to the ethylene emission rate of 10.2 mg/mi to give a normalized emission rate of 11.6 mg/mi. Each ethylene emission for the Probe (all four fuels) was adjusted (i.e., normalized) in a similar manner. These normalized emissions values have thus been corrected for the time drift observed with the baseline fuel emissions.


ETHYLENE CONCENTRATION VS TIME FOR THE
FORD PROBE TESTED WITH THE BASELINE FUEL


ETHYLENE CONCENTRATION VS TIME FOR THE
FORD PROBE TESTED WITH THE 4 TEST FUELS

Test No. 511 512 521 522 523 513 531 532 533 514 541 542 543 515 516

```
Regression Analysis - Linear model: Y = a+bX
-----------------------------------------------------------------------------
Dependent variable: EM905F.ETHYLENE          Independent variable: EM905F.TIME
-----------------------------------------------------------------------------
                                 Standard              T             Prob.
Parameter         Estimate         Error             Value            Level
-----------------------------------------------------------------------------
Intercept          9.91292        0.48377           20.491           .00003
Slope             0.342135      0.0499858          6.84464           .00238
-----------------------------------------------------------------------------

                         Analysis of Variance
-----------------------------------------------------------------------------
Source               Sum of Squares     Df  Mean Square    F-Ratio  Prob. Level
Model                     20.836011      1    20.836011   46.84911       .00238
Error                     1.7789888      4     .4447472
-----------------------------------------------------------------------------
Total (Corr.)             22.615000      5

Correlation Coefficient = 0.959862          R-squared =  92.13 percent
Stnd. Error of Est. = 0.666894
```

APPENDIX F

QUALITY ASSURANCE DOCUMENTATION

March 9, 1990

MEMORANDUM

TO: Project 08-2809 Records

FROM: Robin J. Santos

SUBJECT: **Quality Assurance Verification of Quality Requirements for Contract 68-C9-0004**

A quality audit of Contract 68-C9-0004, SwRI Project 08-2809, was performed by Mr. Vince Ganley and Ms. Robin Santos beginning 3/2/90. Ms. Mary Ann Warner-Selph, Project Leader, was the point of contact for this audit.

The contractual quality requirements for Project 08-2809 are Federal Acquisition Regulation (FAR) 52.246-5, Inspection of Services -- Cost-Reimbursement; and the Quality Assurance Program Plan and Project Plan for "Fuels and Emissions Characterization" (QA Plan) submitted to the U. S. Environmental Protection Agency in the initial proposal and incorporated by reference into Contract 68-C9-0004. The audit and subsequent reporting of audit findings to project personnel and Quality Assurance management satisfies the requirements of FAR 52.246-5.

Activities audited are listed below.

I. Quality Assurance Program

1) Sample retention, Section 5A, page 1 of 1;
2) Reporting of test abnormalities, Section 6A, page 1 of 4;
3) Data reduction, Section 6A, page 3 of 4;
4) Internal quality control checks and corrective action, Section 7A, page 1 of 4;
5) Calibration and maintenance records, Section 8A, page 1 of 1;
6) Specification sheets, Section 8A, page 1 of 1;
7) Data sheets, Section 8A, page 1 of 1;
8) Raw data sheets, Section 8A, page 1 of 1;
9) Data encoding sheets, computer printouts, etc., Section 8A, page 1 of 1;
10) Calculational forms, Section 8A, page 1 of 1;
11) Replicate testing, Section 10A, page 1 of 1;
12) Quality Assurance Reports, Section 11A, page 1 of 1.

II. Contract Requirements

1) Working files, Section F.3;
2) Contract modification, Section G. 5.2;
3) Key personnel, Section H.8;
4) Fuels, SOW, C3, C4;
5) Vehicle selection, SOW, D;
6) Pollutants to be measured, SOW, E;
7) Minimization of carry-over effects, SOW, E;
8) Reports of work, Attachment B.(b).

Actual audit findings are on file in the Quality Assurance Department.

/jar

May 28, 1990

MEMORANDUM

TO: Project 08-2809 Records

FROM: Robin J. Santos
Quality Assurance Engineer

SUBJECT: **Quality Assurance Verification of Quality Requirements for Contract 68-C9-0004, Surveillance No. 90-08-2809-2**

A quality surveillance of Contract 68-C9-0004, SwRI Project 08-2809, was performed by Mr. Vince Ganley and Ms. Robin Santos beginning May 23, 1990. Ms. Mary Ann Warner-Selph, Project Leader, was the point of contact for this surveillance.

The contractual quality requirements for Project 08-2809 are Federal Acquisition Regulation (FAR) 52.246-5, Inspection of Services -- Cost-Reimbursement; and the Quality Assurance Program Plan and Project Plan for "Fuels and Emissions Characterization" (QA Plan) submitted to the U.S.Environmental Protection Agency in the initial proposal and incorporated by reference into Contract 68-C9-0004. The project surveillance and subsequent reporting to project personnel and quality assurance management satisfies the requirements of FAR 52.246-5.

Activities included in the surveillance are listed below:

I. Quality Assurance Program

  1) Sample retention, Section 5A, page 1 of 1;
  2) Reporting of test abnormalities, Section 6A, page 1 of 4;
  3) Data reduction, Section 6A, page 3 of 4;
  4) Internal quality control checks and corrective action, Section 7A, page 1 of 4;
  5) Calibration and maintenace records, Section 8A, page 1 of 1;
  6) Specification sheets, Section 8A, page 1 of 1;
  7) Data sheets, section 8A, page 1 of 1;
  8) Raw data sheets, Section 8A, page 1 of 1;
  9) Data encoding sheets, computer printouts, etc., Section 8A, page 1 of 1;
  10) Calculational forms, Section 8A, page 1 of 1;
  11) Replicate testing, Section 10A, page 1 of 1;
  12) quality Assurance Reports, Section 11A, page 1 of 1.

II. Contract Requirements

  1) Contract modification, Section G, 5.2;
  2) Fuels, SOW, C3, C4;
  3) Vehicle selection, SOW, D;
  4) Pollutants to be measured, SOW, E;
  5) Minimization of carry-over effects, SOW, E;

Actual surveillance findings are on file in the Quality Assurance Department.

scd

DEPARTMENT OF EMISSIONS RESEARCH

VEHICLE PREPARATION VERIFICATION, PROJECT 08-2809-001, EPA

Vehicle	Date	Single or Triple Prep		Prep #1	Prep #2	Prep #3	Initials
Chevy #969	EM 905-F 5-1-90	Triple Prep	Odometer before, mi.	62750	------	------	P.G
			Odometer after, mi.	62757	62765	6[illegible]	
			Distance, mi.	7	7	7	
			Time Start Soak	3:49	5:11	6:[illegible]	
			Time End Soak	4:49	6:11	10.22 AM.	5-2-90
chevy #969	EM-905-F 5-3-90	Triple Prep	Odometer before, mi.	62809	------	------	ES
			Odometer after, mi.	62817	62824	62832	5-3-90
			Distance, mi.	8	7	8	
			Time Start Soak	1:04	2:25	3:47	
			Time End Soak	2:04	3:25	9:25 AM	5-4-90
Chevy #969	EM-906-F 5-6-90	Single Prep	Odometer before, mi.	62850	------	------	dmf
			Odometer after, mi.	62857			
			Distance, mi.	7			
			Time Start Soak	9:00 AM			
			Time End Soak	9:34 AM	5-7-90		
chevy #969	EM-905-F 5-9-90	Triple Prep	Odometer before, mi.	62915	------	------	[illegible]
			Odometer after, mi.	62922	62929	62937	
			Distance, mi.	7	7	8	
			Time Start Soak	12:24	1:47	3:10	
			Time End Soak	1:24	2:47	9:10 AM	5-9-90

5-10-90

DEPARTMENT OF EMISSIONS RESEARCH

VEHICLE PREPARATION VERIFICATION, PROJECT 08-2809-001, EPA

Vehicle	Date	Single or Triple Prep		Prep #1	Prep #2	Prep #3	Initials
chevy #969	EM-907-F 5-10-90	Triple Prep	Odometer before, mi.	62957	------	------	EJ
			Odometer after, mi.	[illegible]	6297[illegible]	62980	
			Distance, mi.	7	7	8	
			Time Start Soak	[illegible]	2:36	3.59	
			Time End Soak	2:13	3:36	9.00 AM	5-11-90
chevy #169	EM-907-F 5-13-90	Single Prep	Odometer before, mi.	62998	------	------	
			Odometer after, mi.	63006			
			Distance, mi.	7.5			
			Time Start Soak	—			
			Time End Soak	4:03	5-14-90		
chevy #969	EM-905-F 5-15-90	Triple Prep	Odometer before, mi.	63044	------	------	EJ
			Odometer after, mi.	63052	63059	63067	RD
			Distance, mi.	8	7	8	
			Time Start Soak	2:47	4:10	5.34	
			Time End Soak	3:47	5.10	9:57	5-16-90 ES
chevy #169	EM-908-F 5-16-90	Triple Prep	Odometer before, mi.	63087	------	------	
			Odometer after, mi.	63094	63102	63109	
			Distance, mi.	7	7	7	
			Time Start Soak	1:56	3:19	4:20	
			Time End Soak	2:56	4:19	9:38	5-17-90

9:38

DEPARTMENT OF EMISSIONS RESEARCH

VEHICLE PREPARATION VERIFICATION, PROJECT 08-2809-001, EPA

Vehicle	Date	Single or Triple Prep		Prep #1	Prep #2	Prep #3	Initials
#969	Fuel EM-	908-F	**Odometer before, mi.**	63149	------	------	
Chevy	5-20-90	Single	**Odometer after, mi.**	63156			
			Distance, mi.	7			
			Time Start Soak	12:10 P.M.			5-20-90
			Time End Soak	9 20 AM			CJ 5-21-90
#969	Em	905-F	**Odometer before, mi.**	63174	------	------	
Chevy	5-21-90	Triple Prep	**Odometer after, mi.**	63182	63189	63197	
			Distance, mi.	8	7	8	5-21-90
			Time Start Soak	1:38	3:01	4:24	
			Time End Soak	2:38	4:01	9:40	5-22-90
			Odometer before, mi.		------	------	
			Odometer after, mi.				
			Distance, mi.				
			Time Start Soak				
			Time End Soak				
			Odometer before, mi.		------	------	
			Odometer after, mi.				
			Distance, mi.				
			Time Start Soak				
			Time End Soak				

Project No: 08-2809-001	
Date: 5-16-90	
Test No: 414	Run No: 1
Veh.No.&Descr: CHEV IMPALA	
Bag Descr: COLD 505 SAMPLE	
Time Bag Finished:	

▨	FTP	SHED
1,3-Butadiene	1: 27 Tsai	▨
Bagcart	10:32 BS	
IHC	YR 11:03	
Speciation	10:25 Tsai	
N2O	10:35 Tsai	▨
Ethanol	▨	

Project No: 08-2809-001	
Date: 5-16-90	
Test No: 414	Run No: 1
Veh.No.&Descr: CHEV IMPALA	
Bag Descr: COLD STAB 867 SAMPLE	
Time Bag Finished:	

▨	FTP	SHED
1,3-Butadiene	12:20 Tsai	▨
Bagcart	[illegible]	
IHC	YR 11 42	
Speciation	12:15 Tsai	
N2O	12:40 Tsai	▨
Ethanol	▨	

Project No: 08-2809-001	
Date: 5-16-90	
Test No: 414	Run No: 1
Veh.No.&Descr: CHEV IMPALA	
Bag Descr: HOT 505 SAMPLE	
Time Bag Finished:	

▨	FTP	SHED
1,3-Butadiene	11:26 Tsai	▨
Bagcart	[illegible]	
IHC	YR 1:42	
Speciation	[illegible]	
N2O	[illegible]	▨
Ethanol	▨	

Project No: 08-2809-001	
Date: 5-16-90	
Test No: 414	Run No: 1
Veh.No.&Descr: CHEV IMPALA	
Bag Descr: COLD STAB 867 BACK	
Time Bag Finished:	

▨	FTP	SHED
1,3-Butadiene	13:16 Tsai	▨
Bagcart	10 [illegible]	
IHC	2:12 Y.R	
Speciation	[illegible] 2:30	
N2O	14:45 Tsai	▨
Ethanol	▨	

Project No: 08-2809-001

Date: 5-16-90

Test No: 414 Run No: 1

Veh.No.&Descr: CHEV IMPALA

Bag Descr: COLD SAMPLE (SHED)

Time Bag Finished: 9:02

▨	FTP	SHED
1,3-Butadiene		▨
Bagcart		10:13 [illegible]
IHC		YR 10:31
Speciation	9:45 Tsai	
N2O		▨
Ethanol	▨	[illegible]

Project No: 08-2809-001

Date: 5-16-90

Test No: 414 Run No: 1

Veh.No.&Descr: CHEV IMPALA

Bag Descr: COLD BACK (SHED)

Time Bag Finished: 9:09

▨	FTP	SHED
1,3-Butadiene		▨
Bagcart		10:15 [illegible]
IHC		YR 10 05
Speciation		[illegible]
N2O		▨
Ethanol	▨	[illegible]

Project No: 08-2809-001

Date: 5-16-90

Test No: 414 Run No: 1

Veh.No.&Descr: CHEV IMPALA

Bag Descr: HOT SAMPLE (SHED)

Time Bag Finished: [illegible]

▨	FTP	SHED
1,3-Butadiene		▨
Bagcart		12:3 [illegible]
IHC		1:10 DB
Speciation		DB 5:00pm
N2O		▨
Ethanol	▨	[illegible]

Project No: 08-2809-001

Date: 5-16-90

Test No: 414 Run No: 1

Veh.No.&Descr: CHEV IMPALA

Bag Descr: HOT BACK (SHED)

Time Bag Finished: [illegible]

▨	FTP	SHED
1,3-Butadiene		▨
Bagcart		11:00 [illegible]
IHC		12 43 YR
Speciation		[illegible]
N2O		▨
Ethanol	▨	[illegible]

DEPARTMENT OF EMISSIONS RESEARCH

[illegible] 421

Wet Chemistry Data Sheet

Project No: [illegible] **Date:** [illegible] **Cell No:** [illegible] Analy **Initials:** [illegible] **Page** **of**

TEST NO.	**RUN**	**TIME**	**B.P.**	**ANALYSIS**	DNPH	BACK DNPH	ETHANOL	BACK ETHANOL
FTP		9:22	28.94	**VOLUME**	3506	3415	3319	3662
				TEMP	74°	73°	74°	73°
HWY SDS		9:55	28.96	**VOLUME**	1336	1251	1217	1393
				TEMP	75°	76°	75°	76°
HWY STABLE		11:32	28.97	**VOLUME**	2257	2157	2158	2392
				TEMP	74	74°	74°	74°
COLD SHED		9:05 9:40	28.96 28.96	**VOLUME**			5000	5001
				TEMP			72°	71°
HOT SHED		12:32 12:16	28.96 28.97	**VOLUME**			5045	5001
				TEMP			73°	72°
				235° **LEAK CHECK**	✓	✓	✓	✓
				SAMPLE LINE TEMP	234°	231°	231°	231°
Sample Flow Rate Within Acceptable Range?				12: 11.4 – 12.6 80: 76.0 – 84.0 120: 114.0 – 126.0	yes	yes	yes	yes

Comments:

SOUTHWEST RESEARCH INSTITUTE
QUALITY CONTROL CHECKLIST

Project No. 08-2809-001 Date 5/21/90 Test No. 443

Examine Drivers Trace

- ✓ Mark all deviations from driver trace and reason

Show conformity for heat build test on trace

- ✓ Initial temperature between 58 and 62°F
- ✓ Heat build rate ±3°F at all points
- ✓ Final temperature 24±1°F higher than initial temperature after 60±2 minutes
- ✓ Less than 1 hour from end of shed diurnal test to beginning of cold start 505
- ✓ Less than 2 minutes from end of hot start 505 to sealing shed for hot soak test

Sample time between 505 sec. and 515 sec. for cold or hot start 505

Roll counts

- ✓ Cold Start 505 8250-8575
- ✓ Stabilize 867 8850-9150
- ✓ Hot Start 505 8250-8575

CVS

- ✓ Inlet pressure ±5 inches H_2O
- ✓ Inlet temperature ±10°F

Initials SR

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. 460/3-91-002	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE ASSESSMENT OF UNREGULATED EMISSIONS FROM GASOLINE OXYGENATED BLENDS		5. REPORT DATE February 1991
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Mary Ann Warner-Selph Lawrence R. Smith		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Southwest Research Institute P.O. Drawer 28510 San Antonio, Texas 78228-0510		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO. 68-C9-0004
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Protection Agency 2565 Plymouth Road Ann Arbor, Michigan 48105		13. TYPE OF REPORT AND PERIOD COVERED FINAL (3-89 to 9-90)
		14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

Four gasoline or gasoline-oxygenate blend fuels were used in the evaluation of regulated and unregulated emissions for five test vehicles. The fuels listed below were all prepared from a common base gasoline and were blended to have equal octane ratings.

- Baseline, aromatic-enriched
- 10% Ethanol blend
- 16.4% Methyl tertiary-butyl ether (MTBE) blend
- 19.1% Ethyl tertiary-butyl ether (ETBE) blend

The five test vehicles represented different types of emissions control technology: pre-catalyst, oxidation catalyst, three-way catalyst with closed-loop carburetor operation and an air pump, three-way catalyst with throttle body fuel injection, and three-way catalyst with port fuel injection. Each vehicle was operated with each fuel over the Federal Test Procedure (including evaporative emissions) for a total of 15 tests per vehicle. Several unregulated exhaust emissions were measured including ethylene, 1,3-butadiene, isobutylene, benzene, toluene, o-, m-, and p-xylenes, formaldehyde, acetaldehyde, ethanol, MTBE, and nitrous oxide. In addition, evaporative emissions were analyzed for MTBE, benzene, and ethanol. The emission data from tests using the ethanol, MTBE, and ETBE blends were compared to emissions produced from tests using the aromatic-enriched baseline fuel to determine if there were any statistically significant differences associated with the use of the blends.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Exhaust Emissions Evaporative Emissions Motor Vehicles Oxygenated Fuels	Emissions Characterization Emission Test Procedures Light-Duty Vehicles MTBE Blend ETBE Blend Ethanol Blend	

18. DISTRIBUTION STATEMENT RELEASE UNLIMITED	19. SECURITY CLASS *(This Report)* UNCLASSIFIED	21. NO. OF PAGES 197
	20. SECURITY CLASS *(This page)* UNCLASSIFIED	22. PRICE

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